Integrated Resource Inventory

Ecological Zonation of Northwestern Alberta

Volume I

Alberta

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Resource Evaluation
and Planning

ECOLOGICAL ZONATION
OF
NORTHWESTERN ALBERTA

by

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ABSTRACT

This report provides an ecological classification for the forest ecosystems of Northwestern Alberta. The study area extends from latititude 55° north to the Northwest Territories border and from longitude 114° west to the British Columbia border.

A total of three ecological zones are recognized; Boreal Subarctic, Boreal Mixedwood and Aspen Parkland. The Boreal Mixedwood is subsequently divided into upper and lower subzones. The lower subzone contains an Aspen-White Spruce variant and a White/Spruce-Aspen variant.

Twenty-six plant associations are described for the three zones in the area. Descriptions include information on vegetation structure, soil characteristics and site factors. Forest productivity is also summarized for most associations. Climate data was analysed for the study area as an aid to delineation of the zones and is presented in an overview for each zone and in detail in the Appendix.

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1. INTRODUCTION

Ecological classification (formerly called biogeoclimatic classification) of Alberta forests was initiated in 1976 based on agreement between the Alberta Forest Service and the Canadian Forestry Service. The main objectives of the project included: 1) classification and mapping of ecological zones; 2) classification of the forests of the province into plant associations; 3) analysis of forest-environment relationships; 4) provision of basic information on the plant associations in terms of structure, ecological characteristics and potential for forest production; and 5) application of this classification system in forest management practices and research programs. Since initiation of the program, a number of provincial reports have been assembled. Since 1981 the Resource Evaluation and Planning Division has undertaken a large portion of the data collection and analysis. This report is a further refinement of the Ecological Classification of the Northwestern portion of the province which was undertaken as a joint project between the Forest Research Branch, Alberta Forest Service and Resource Evaluation Branch, Resource Evaluation and Planning Division.

The objective of the study was to map the zones and subzones of Northwestern Alberta at a scale of 1:500 000 and to describe them in terms of major plant associations, soils and regional climate. The

area was previously mapped at a broad level by Kojima (1983) and Strong and Leggat (1982). Because of the large size of the area and the diversity of ecosystems, it was felt that further refinement of the classification was necessary to adequately address forest and land management problems. A study was undertaken in 1984 to accomplish this task.

The study area includes the northwestern portion of the province from 55° latitude north to the NWT border and from 114° longtitude west to the B.C. border (Fig. 1).

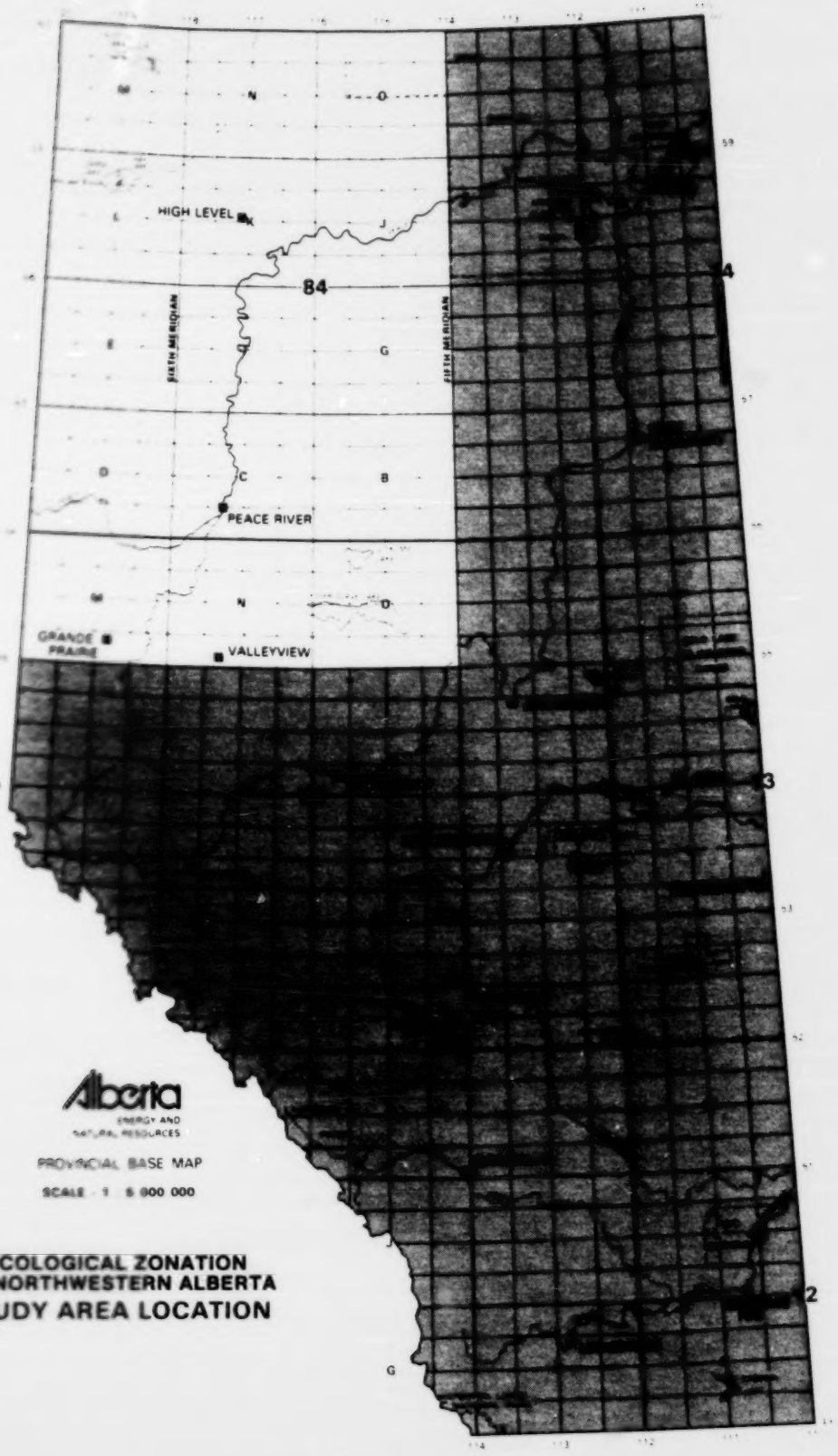

Figure 1:

ECOLOGICAL ZONATION OF NORTHWESTERN ALBERTA
STUDY AREA LOCATION

2. CLASSIFICATION SYSTEM AND METHODS

2.1 Classification System

The Biogeoclimatic Classification system that was developed in British Columbia by V.J. Krajina and his students is derived from several classification systems, summarized by Mueller-Dombois and Ellenberg (1974). The ecological classification system applied in Alberta follows the general principles outlined by Krajina, though modifications have been made to allow for Alberta conditions. The definitions given in this report vary in wording and slightly in concepts from those given by Kojima (1980) and by I.G.W. Corns and Richard M. Annas (1986) in order to adequately classify the landscape and vegetation of Northwestern Alberta.

The classification system provides for two levels of ecosystem description; at a general or zonal level and at a detailed or site level.

2.1.1 Zonal Classification

Zonal classification has three hierarchial levels: zone, subzone and variant.

Zone - a geographical area characterized by a distinctive regional climate as expressed by vegetation. It has a distinct

mature plant association on modal sites and is characterized by zonal soils.

Subzone - a subdivision of the zone that has distinctly different vegetation patterns because of subregional climatic variability yet has the same mature plant association as the zone to which it belongs.

Variant - a subdivision of the subzone that recognizes differences in vegetation distribution induced primarily by physiographic variation. Local climatic variation is expected at this level, but, the dominant factors controlling vegetation distribution are physiographic.

2.1.2 Site Classification

There are two levels of site classification discussed in this report: Individual point data which includes vegetation, soil and environmental characertistics and plant association classification.

Point Data - these are collected at sample points selected to represent homogeneous ecological conditions. Data collected include vegetation composition and cover, soil profile description and environmental data. Specifications for this data collection are given in Alberta Energy and Natural Resources (1985) Integrated Resource Inventory Site Manual.

Plant Association - a grouping of individual sample points with similar vegetation composition, environmental and soil characteristics. The term plant association is not restricted

in application to climax plant communities within this report. Seral stages (i.e. those with successional tree species) are also recognized as plant associations. This recognition reflects the predominance of seral communities within this study area.

2.2 Methods

The project was undertaken in five phases. Initially, a literature review was conducted under a contract to Western Ecological Services Ltd. This was followed by a review of existing data, the major source being biogeoclimatic plots established in 1977/78.

The third phase involved collection of three additional data sets.

1. Establishment of 75 plots in selected areas of the Clear Hills, Buffalo Head Hills, the Caribou mountains and in the Aspen Parkland Area.

2. Establishment of 30 plots in the Aspen Parkland - Boreal Mixedwood transition area (contract by J. Snyder of Grande Prairie College).

3. Collection of vegetation and soil data from 65 permanent sample plots in the area.

Plots established in Part One of this phase included soils, vegetation and tree mensuration data. The permanent sample plot sampling included only vegetation and soils as tree mensuration data are available

through the Alberta Forest Service. The contract work undertaken included only vegetation and soil data. Methods for analysis of this data are given in Appendix 1. Plot locations are shown on Fig. 2 (in pocket). A complete list of plant species found in the study is given in Appendix 2.

The fourth phase of the project involved five major reconnaissance flights to obtain a regional overview. A total of 20 less detailed plots were established during these flights.

In addition, climatic data from climate station and lookout towers was analysed (Fig. 3). Parameters chosen for analysis include growing degree days, summer precipitation, winter precipitation, frost-free period, mean annual temperature, summer mean temperature, January mean temperature, potential evapotranspiration and moisture deficit. These data are incorporated in the zonal descriptions and are presented in Appendix 3.

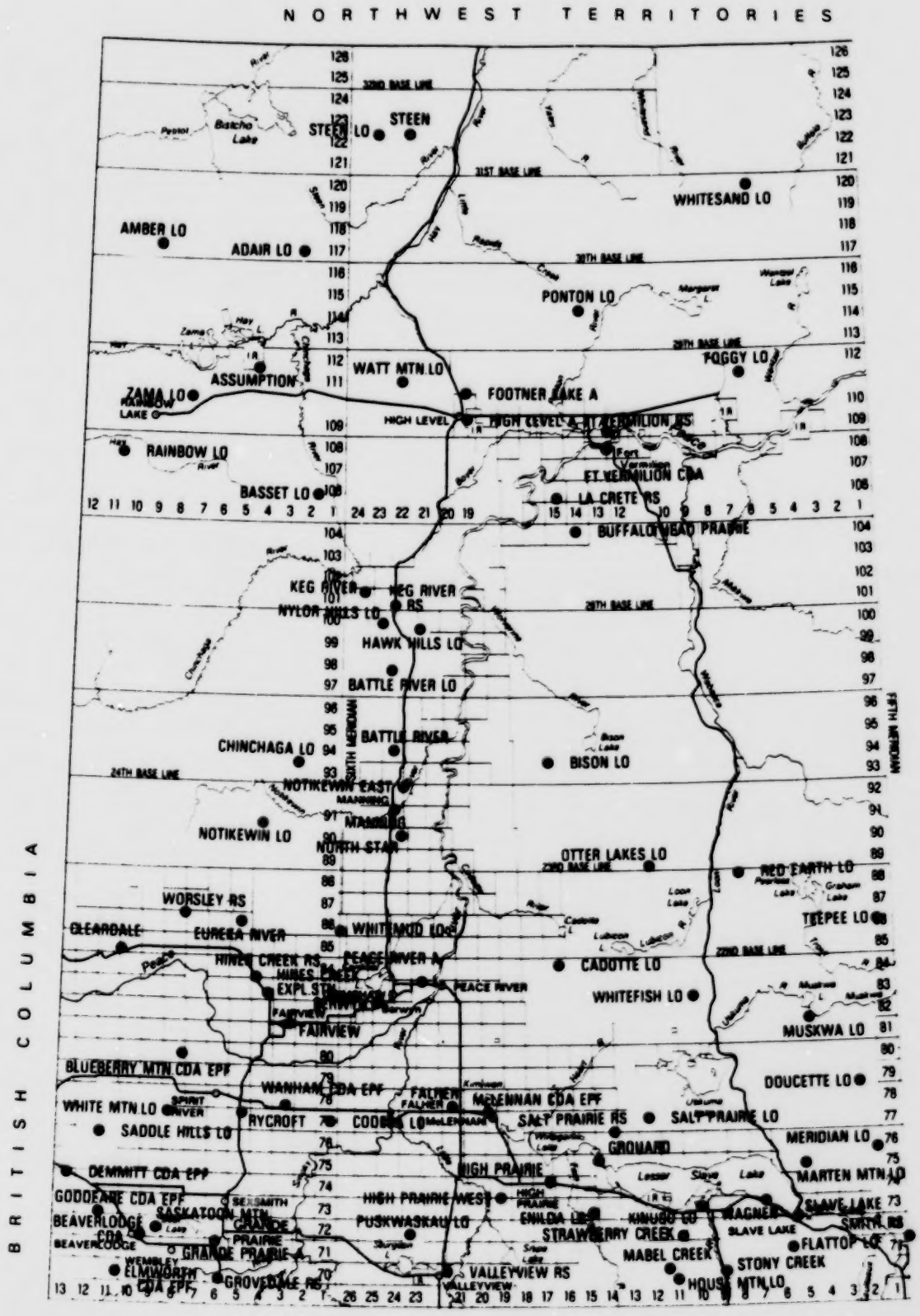

Figure 3: **ECOLOGICAL ZONATION OF NORTHWESTERN ALBERTA**
CLIMATE STATION MAP
SCALE - 1 : 2 500 000

3. STUDY AREA DESCRIPTION

3.1 Physiography, Surficial Materials, Bedrock Geology

The area slopes to the northeast and consists of a number of isolated uplands and surrounding lowlands. Three major rivers, the Peace, the Hay and the Slave drain the study area.

The uplands have subdued elevations (350 - 1 000 m), and hummocky and undulating surface expression. Figure 4, after Pettapiece (1985), shows the distribution of the uplands. These are:

1. H1 - Cameron Hills Upland (450-800 m)
2. H2 - Cariboo Mountain Upland (elev. 450-1 000 m)
3. H3 - Clear Hills Upland (elev. 400-1 050 m)
4. H4 - Buffalo Head Hills Upland (elev. 400-900 m)
5. H5 - Birch Mountain Upland (elev. 350-800 m)
6. H6 - Utikima Uplands (elev. 600-1 000 m)
7. J1 - Wapiti Plains (elev. 600-900 m)
8. J2 - Saddle Hills Upland (elev. 700-1 000 m)
9. J3 - Swan Hills Upland (elev. 600-1 300 m)

The major class of surficial material is morainal in veneer (<1.0 m) or blanket (>1.0 m) form, derived from glacial ice of the last glacial period. The higher reaches of the Cariboo Mountain Upland, Cameron Hills Upland, Clear Hills Upland, Buffalo Head Uplands were not as heavily covered by ice, thus Cretaceous and Tertiary sediments (approx. 40 million years old) are in evidence (Gravenor and Bayrock 1961).

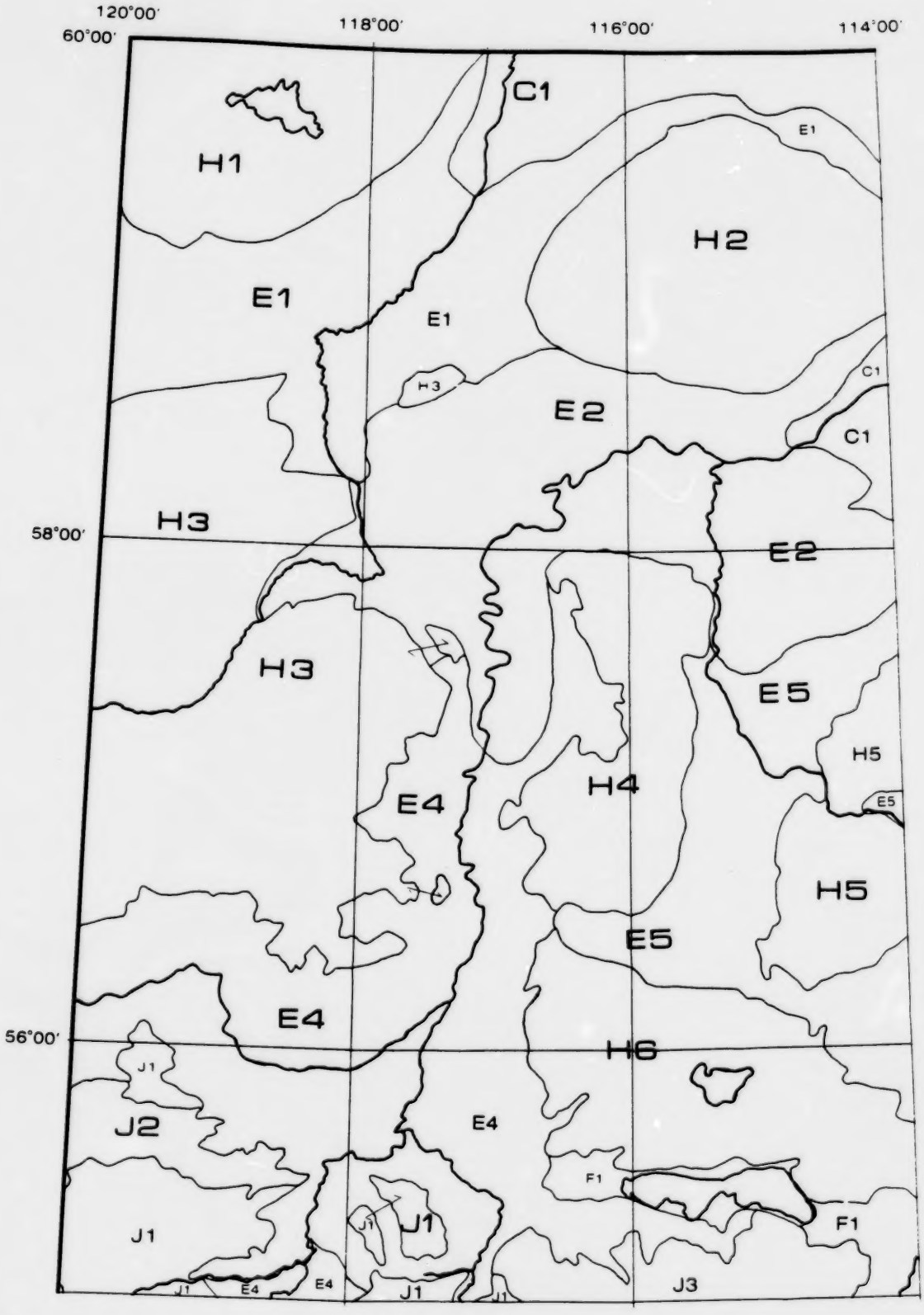

Figure 4: Physiographic Sections of Northwestern Alberta.

The bedrock underlying the uplands is shown in Figure 5, redrawn from Green (1970). The bedrock types of the uplands are of fine textured sedimentary rocks, are of marine origin and formed during the Cretaceous Epoch (some 130-70 million years ago). Parts of the Clear Hills consist of clayey sandstone and mudstones of nonmarine origin.

The uplands are surrounded by a number of lowlands forming a continuous trough. Their distribution is shown in Figure 4, redrawn from Pettapiece (1985). These are:

1. C1 - Great Slave Plain (elev. 200-350 m)
2. E1 - Fort Nelson Lowland (elev. 275-750 m)
3. E2 - Vermillion Lowland (elev. 420-750 m)
4. E4 - Peace River Lowland (elev. 275-750 m)
5. E5 - Wabasca Lowland (elev. 275-600 m)
6. F1 - Lesser Slave Lowland (elev. 550-650 m)

Most of these lowlands existed at their present location before the past glaciation. The last glacial advance, however, and the subsequent rapid retreat, markedly altered the surface materials from which present soils have formed.

Firstly, advancing "cold ice", moving in a south westerly direction from the Northwest Territories (Keewatin Centre), deposited unsorted fine textured materials derived from fine textured bedrock. This material is referred to as ground moraine and may have level to undulating surface expression.

In response to a rapid warming of the regional climate about 11 000 years ago, a massive down-wasting occurred. The resulting

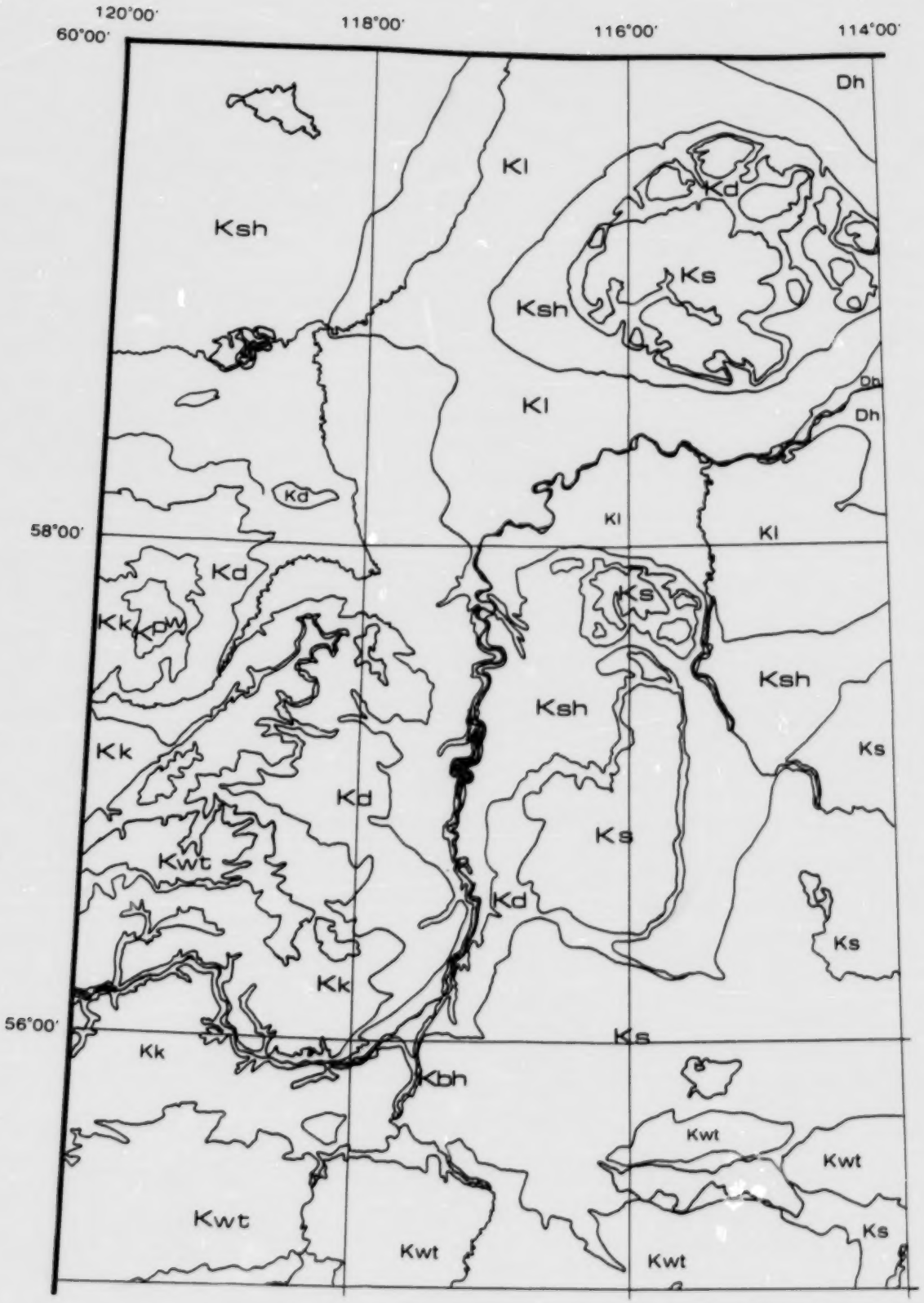

Figure 5: Bedrock Geology of Northwestern Alberta.

glacial lakes left the extensive fine-textured glaciolacustrine deposits of the lowlands. These were laid over ground moraine and are of variable thickness-blanket (>1 m) to veneer (<1 m). Another common form of surficial deposit is dead-ice moraine characterized by hummocky topography.

More recent surficial deposits in the area are extensive organic (peat bogs to fens) materials, fluvial terraces, fluvial fans, sand dunes and colluvial landforms.

The bedrock types (Green 1961) are similar, in texture and age, to those of the uplands. Only the Vermilion Lowlands are underlain by a rock type (silty shale and laminated siltstones) not common in the uplands.

3.2 Soils

Soils of the area have been studied in several preliminary soil surveys (Lindsay et al. 1957, 1958, 1959, 1960 and 1963) and more detailed reconnaissance soil surveys (Odynsky et al. 1952, 1956, 1961, Schellar and Odynsky 1968, Reeder and Odynsky 1969 and Twardy and Corns 1980).

The Organic soils formed on various organic landforms are confined to areas with poor drainage and positive moisture balance, enhanced by slowly permeable underlying parent materials. Organic soils are the most common in the study area. The distribution of organic soils is shown in Fig. 6 (Alberta Energy and Natural Resources, 1983). In upland areas permafrost is present within 1 m of the

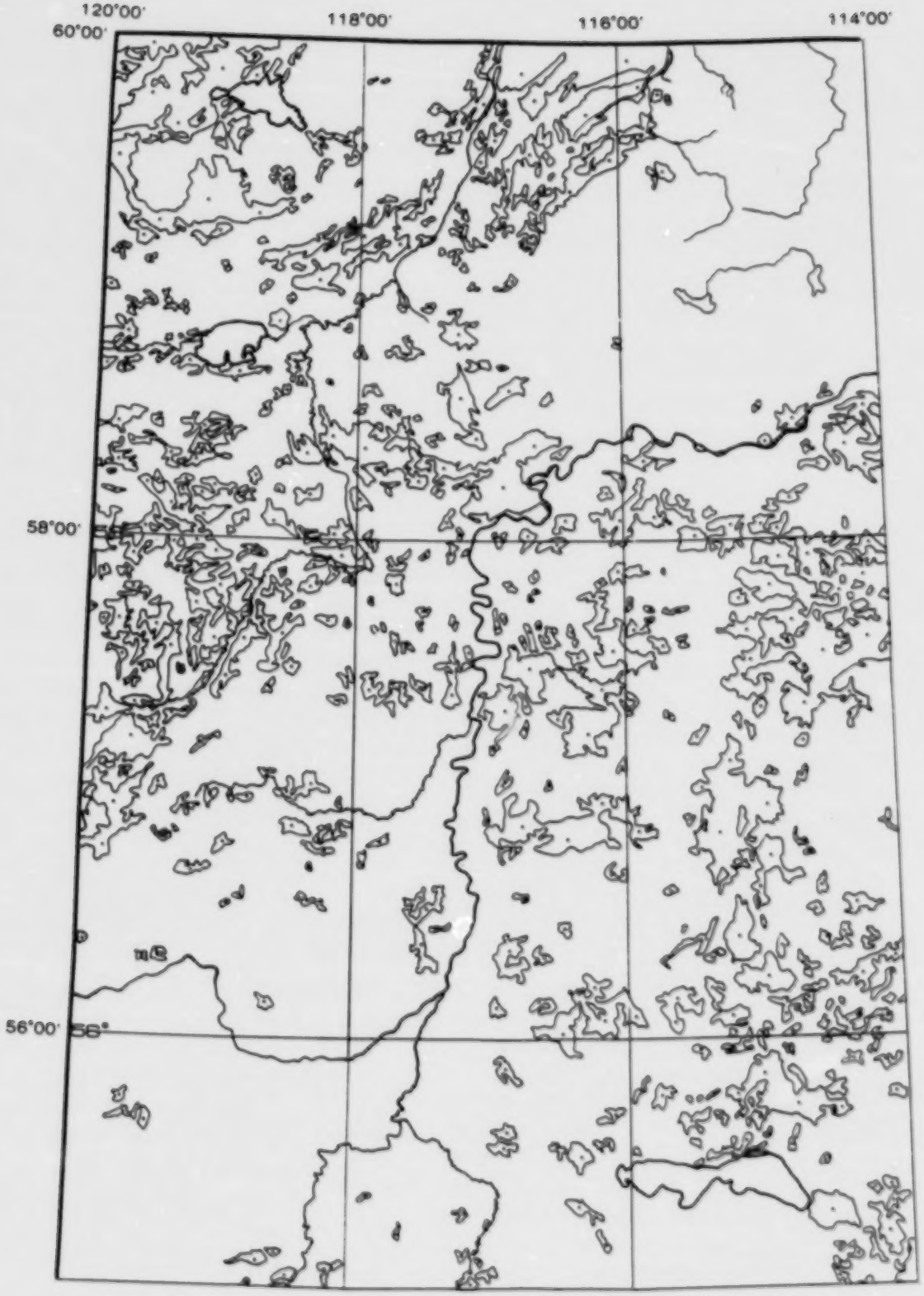

Figure 6: Organic Soils of Northwestern Alberta.

surface (Organic Cryosols). Cryosolic mineral soils are also present.

Another common soil type in the area are the Solonetzic and Solonetzic Gray Luvisol soils. These form in saline water discharge areas and where the Cretaceous bedrock is rich in sodium salts. The distribution of the Solonetzic soils is shown in Fig. 7 (Peters 1982).

On well to imperfectly drained mineral parent materials, and under forest cover, Luvisolic and Brunisolic soils are common. In grass dominated areas of the Peace River Valley Chernozemic soils (except Brown Chernozems) may also occur.

On imperfectly to poorly drained mineral parent materials, Gleysolic soils develop. Regosols occur on colluvial, aeolian and alluvial landforms.

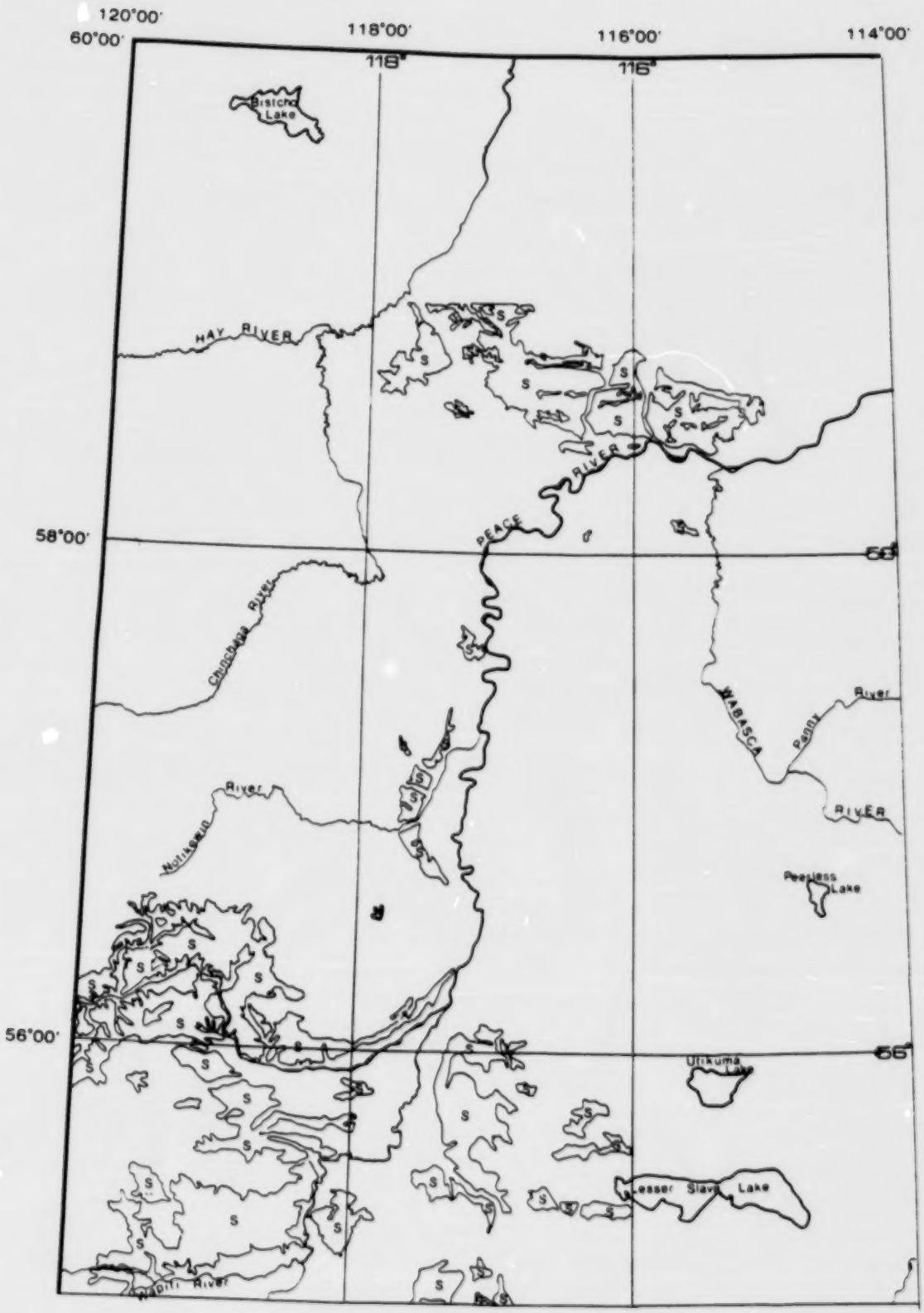

Figure 7: Solonetzic Soils of Northwestern Alberta.

4. ZONAL CLASSIFICATION IN THE STUDY AREA

Three zones have been identified in the study area, Boreal Mixedwood, Boreal Subarctic and Aspen Parkland (Fig. 8). These separations are based on significant differences in vegetation, soils and climate as shown in Tables 1 and 2. Detailed vegetation and site data are in Appendix 4.

The Boreal Mixedwood is further divided into two subzones; Boreal Mixedwood Upper and Boreal Mixedwood Lower. The latter is subsequently divided into two variants; Aspen-White Spruce and White Spruce-Aspen. These divisions are explained in detail in subsequent sections of this report. The Boreal Subarctic and Aspen Parkland are not subdivided below the zone level as only small portions of these zones are present in the study area.

Table 1

VEGETATION AND SOIL CHARACTERISTICS OF THE ZONES OF NORTHWESTERN ALBERTA

Zone	Dominant Tree Species	Significant Understory Species	Dominant Soils
Boreal Mixedwood	Aspen, White spruce, Lodgepole pine	Low-bush cranberry, Rose, Dewberry, Feathermoss	Luvisols, Organic, Brunisol
Boreal Subarctic	Black spruce, Lodgepole pine	Northern Labrador tea, bog bilberry, lichen spp.	Cryosols, Brunisols
Aspen Parkland	Aspen	Rose, Snowberry, Wild vetch, grass spp.	Solonetz, Chernozems, Luvisols

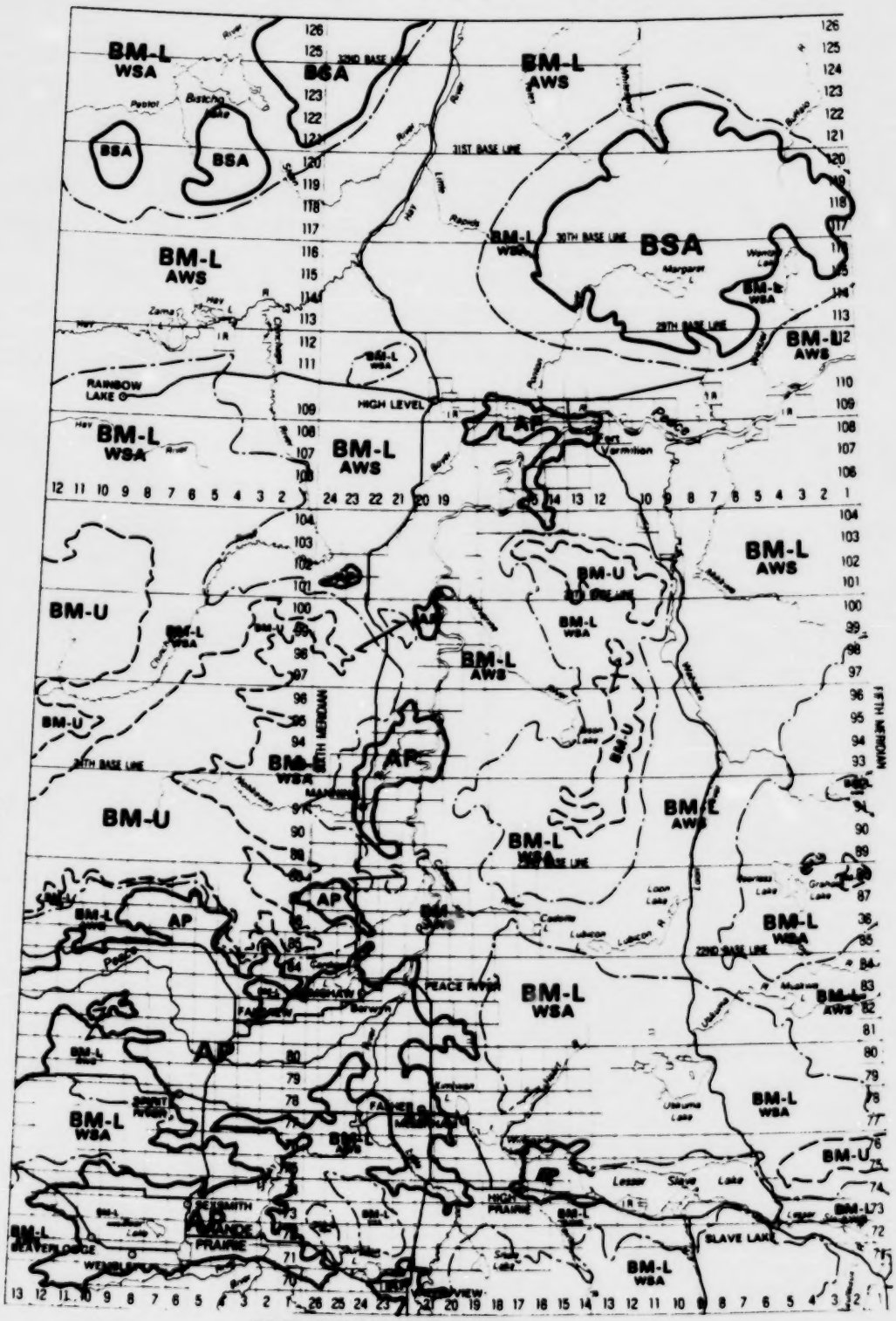

Figure 8: **ECOLOGICAL ZONATION OF NORTHWESTERN ALBERTA** SCALE - 1 : 2 500 000

LEGEND

ZONE	SUBZONE	VARIANT	DOMINANT TREE SPECIES	DOMINANT SOILS
Boreal Subarctic (BSA)	-		Black Spruce/Lodgepole Pine	Cryosols, Brunisols
Boreal Mixedwood (BM)	Upper (U)	-	Lodgepole Pine/White Spruce	Luvisols, Brunisols
	Lower (L)	White Spruce-Aspen (WSA)	White Spruce/Aspen	Luvisols
		Aspen-White Spruce (AWS)	Aspen/White Spruce	Luvisols
Aspen Parkland (AP)	-		Aspen/Grassland	Solonetz, Chernozems, Luvisols

Table 2

SELECTED CLIMATE PARAMETERS FOR ZONES
OF NORTHWESTERN ALBERTA

Zone	Mean Growing Degree Days (above 5°C)	Mean Summer Precipitation (mm)	Mean Summer Temperature (°C)	Mean Potential Evapotranspiration (mm)
Boreal Mixedwood	1 046.6	330.8	11.6	412
Boreal Subarctic	846.6	260.1	9.7	307
Aspen Parkland	1 181.6	259.6	12.6	507

4.1 Boreal Subarctic Zone

The Boreal Subarctic Zone occurs on upland areas, the Cariboo Mountains and Cameron Hills, in the extreme northern portion of the province. The zone line coincides approximately with the top of the steep side slopes of these uplands. Lower elevations range from approximately 760 m in the Cariboo Mountains to 670 m in the Cameron Hills area.

The Boreal Subarctic Zone is very distinct from the other zones of northwestern Alberta. The vegetation pattern changes abruptly to black spruce and lodgepole pine at the top of these hills while the side slopes, which are part of the Boreal Mixedwood Zone, are dominated by white spruce and aspen. Soils are also distinctive with Cryosols and Brunisols dominant in the zone.

Climate Conditions

Climate information is limited for the ecozone, but there are some significant differences from the other zones in the area. Growing degree days are the lowest for the study area with a mean of 847 degree days above 5°C. Summer precipitation (260 mm May-Sept.) is lower than other zones with the exception of the Aspen Parkland. Annual precipitation is lowest in the northern area with a mean of 376 mm. More detailed climatic information and analysis is given in Appendix 3.

Ecological Conditions

Black spruce and lodgepole pine are the dominant tree species with black spruce the expected climax species for the ecozone. Bog bilberry (**Vaccinium uligosum**) and northern Labrador tea (**Ledum palustre**) are characteristic shrub species as they only occur sporadically in other zones of northern Alberta. Lichen cover is significantly higher in this zone than elsewhere in northern Alberta.

Well drained sites are occupied by lodgepole pine stands that are successional to black spruce. Soils are usually Brunisols with some Brunisolic Gray Luvisols.

Poorly drained sites support open black spruce forest that has high ericaceous shrub and lichen cover in the understory. Soils are usually Organic Cryosols with a frozen layer beginning at approximately 40 cm.

Very poorly drained lower slope and valley bottom locations have developed sedge and shrub dominated fens. These are described in detail in Lee et al. (1981) and were not sampled in this survey.

There are two recognizable plant associations in the Boreal Subarctic: Lodgepole pine-Black spruce/Labrador tea/Lichen and Black spruce/Norhern Labrador tea/lichen.

Lodgepole pine-Black spruce/Labrador tea/Lichen
Pinus contorta-Picea mariana/Ledum groenlandicum/Cladina spp.

Site and Soil Characteristics

Slope	:	4.2% (0-7)
Aspect	:	Variable
Parent materials	:	Morainal
Texture	:	Variable
Soil drainage	:	Well to moderately well
Ecological moisture regime	:	Submesic to mesic
Ecological nutrient regime	:	Submesotrophic to mesotrophic
Soils	:	Brunisolic Gray Luvisol, Eutric Dystric Brunisol, Orthic Eutric Brunisol, Eluviated Eutric Brunisol
Number of plots	:	5

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Pinus contorta**	Lodgepole pine	14.0
	Picea mariana	Black spruce	7.0
Shrub	**Ledum groenlandicum**	Labrador tea	18.2
	Picea mariana	Black spruce	4.6
Herb	**Vaccinium vitis-idaea**	Bog cranberry	10.0
	Cornus canadensis	Bunchberry	2.6
Grass	Less than 60% presence		
Moss	**Pleurozium schreberi**	Schreber's moss	19.0
	Hylocomium splendens	Stair-step moss	18.2

Layer	Species		Mean Cover (%)
Lichen	**Cladina mitis**	Reindeer lichen	14.2
	Cladina rangiferina	Reindeer lichen	3.4
	Peltigera aphthosa	Studded leather lichen	2.8
	Cladina stellaria	Reindeer lichen	2.6
	Cetraria nivalis		1.8

Comments

This association is restricted to morainal knolls in the zone.

Black spruce/Northern Labrador tea/Lichen
Picea mariana/Ledum palustre/Cladina spp.

Site and Soil Characteristics

Slope	:	0.7% (0-2)
Aspect	:	Variable
Parent materials	:	Organic
Texture	:	Mostly fibric
Soil drainage	:	Very poor to poor
Ecological moisture regime	:	Hygric to subhygric
Ecological nutrient regime	:	Oligotrophic
Soils	:	Fibric Organic Cryosol and Mesic Organic Cryosol
Number of plots	:	3

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea mariana**	Black spruce	2.3
Shrub	**Ledum palustre**	Northern Labrador tea	26.7
	Picea mariana	Black spruce	23.4
Herb	**Vaccinium vitis-idaea**	Bog cranberry	5.7
	Rubus chamaemorus	Cloudberry	1.3
	Andromeda polifolia	Bog rosemary	0.7
Lichen	**Cladina mitis**	Reindeer lichen	38.3
	Cetraria nivalis		7.3
	Cladina rangiferina	Reindeer lichen	5.7
	Cladina stellaris	Reindeer lichen	2.0
	Cladonia cornuta	Reindeer lichen	0.7

Comments

This association is widespread throughout the zone, usually on Cryosolic soils which are frozen at approximately 40 cm below the surface even during the growing season.

4.2 Boreal Mixedwood

The Boreal Mixedwood Zone is the largest in the northwestern parts of the province, covering approximately 80% of the landscape. It encompasses a wide range of environmental conditions subdivided into two subzones - Upper and Lower Boreal Mixedwood. The upper subzone, which is dominated by lodgepole pine, is found at higher elevations (above 760 masl) of the major uplands in the area namely the Clear, Milligan and Buffalo Head Hills and Pelican Mountain. The lower subzone is divided into two variants: white spruce-aspen and aspen-white spruce. This distinction is based largely on physiography as the white spruce-aspen variant is found on morainal materials on the lower slopes of the uplands (and on some smaller upland areas) while the aspen-white spruce variant occur on the relatively flat, dominantly lacustrine materials in the lowlan of the study area. The variant boundary coincides with upland areas delineated on the Physiographic Regions of Alberta map (Fig. 4).

Climate Conditions

The Boreal Mixedwood has a less severe climate than the Boreal Subarctic and a more severe climate then the Aspen Parkland. Table 3

Table 3

SELECTED CLIMATIC PARAMETERS FOR SUBZONES AND VARIANTS WITHIN THE BOREAL MIXEDWOOD

Classification Unit	Summer Precipitation (mm)	Growing Degree Days (above 5°C)	Potential Evapotranspiration (mm)	Moisture Deficit (mm)	Summer Temperature (mm)
Boreal Mixedwood Zonal Average	330.8	1046.6	412.9	-84.4	11.6
Boreal Mixedwood Upper	381.0	935.3	317.9	82.7	10.7
Boreal Mixedwood Lower White Spruce Aspen	339.9	1043.8	374.1	-39.9	11.6
Boreal Mixedwood Lower Aspen-White Spruce	295.0	1091.6	476.8	-180.0	12.0

shows the average climate for the zone and is further broken down by subzone and variant. Significant differences are found in growing degree days, rainfall, potential evapotranspiration and moisture deficit.

Ecological Conditions

The Boreal Mixedwood Zone, while exhibiting considerable variability, has a number of characteristics that distinguish it from other zones. The climax species on model sites throughout the zone are white spruce and balsam fir. The balsam fir component is rarely found, however, because the high frequency of fire retards long-term successional trends. Black spruce often accompanied by tamarack, is found on wet sites throughout the zone. Dry sites are occupied by jack pine or lodgepole pine with the former more common on lowlands and the latter prevalent in upland areas. The zonal soils are Gray Luvisols with Orthic, Gleyed, Solonetzic and Brunisolic subgroups being common. Organic soils are very common in the zone because of extensive wetlands, particularly in association with lacustrine materials. Brunisols are found on coarse materials, often in association with jack pine or lodgepole pine forests.

Common understory shrubs on modal sites are rose, low-bush cranberry, and buffalo-berry. The herb layers are quite variable but bunchberry, dewberry, wild sarsaparilla, fireweed and showy aster are very common. Development of the moss layer is related to the succession status of the stands with heavy moss layers associated with the more advanced successional stages.

4.2.1 Boreal Mixedwood Upper Subzone

Lodgepole pine is the dominant pioneer tree species in the subzone as opposed to aspen in the lower subzone. This can be attributed to the harsher climate at the higher elevations. White spruce and balsam fir are the climax species for the area but the frequent occurrence of fire results in much of the area being in pioneer successional stages. Soils are Orthic and Brunisolic Gray Luvisols on modal sites. Parent materials consist largely of rolling morainal deposits. There are seven associations identified in this subzone:

Lodgepole pine/Labrador tea/Feathermoss

Lodgepole pine/Low-bush cranberry/Feathermoss

Lodgepole pine/Alder/Bunchberry

White spruce/Low-bush cranberry/Feathermoss

White spruce/Alder/Feathermoss

White spruce-Balsam fir/Feathermoss

Black spruce/Labrador tea/Peat moss

Lodgepole Pine/Labrador tea/Feathermoss
Pinus contorta/Ledum groenlandicum/Pleurozium schreberi

Site and Soil Characteristics

Slope	:	2.9% (0-7)
Aspect	:	Variable
Parent materials	:	Morainal (veneer and blanket), glacio-lacustrine
Texture	:	Medium to moderately fine, moderately fine to fine and moderately coarse to moderately fine in A, B and C horizons respectively
Soil drainage	:	Well to moderately well drained, occasionally imperfectly drained
Ecological moisture regime:		Mesic to subhygric
Ecological nutrient regime:		Mesotrophic to submesotrophic

Soils	:	Orthic and Gleyed Gray Luvisols, Dystric Brunisols and less frequently Luvic Gleysol
Number of plots	:	11

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Pinus contorta**	Lodgepole pine	32.8
	Picea mariana	Black spruce	8.6
Shrub	**Ledum groenlandicum**	Labrador tea	11.6
Herb	**Vaccinium vitis-idaea**	Bog cranberry	7.9
	Cornus canadensis	Bunchberry	6.6
	Equisetum sylvaticum	Woodland horsetail	0.6
Grass	Presence < 60%		
Moss	**Pleurozium schreberi**	Schreber's moss	31.2
	Hylocomium splendens	Stairstep moss	12.1
	Ptilium crista-castrensis	Knight's plume moss	1.5
Lichen	**Cladina mitis**	Reindeer lichen	9.0
	Peltigera aphthosa	Studded leather lichen	1.1

Comments

Represents moist sites with lower nutrient availability than the following association.

Lodgepole pine/Low-bush cranberry/Feathermoss
Pinus contorta/Viburnum edule/Pleurozium schreberi

Site and Soil Characteristics

Slope	:	2.9% (0-5)
Aspect	:	Variable
Parent materials	:	Morainal (veneer and blanket), glacio-lacustrine
Texture	:	Medium, moderately fine to fine, moderately fine to very fine in the A, B and C horizons, respectively
Soil drainage	:	Well to imperfectly drained
Ecological moisture regime	:	Mesic

Ecological nutrient regime: Mesotrophic to submesotrophic
Soils : Brunisolic and Orthic Gray Luvisols
Number of plots : 8

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Pinus contorta**	Lodgepole pine	25.6
	Populus tremuloides	Aspen	9.0
	Picea glauca	White spruce	5.1
Shrub	**Viburnum edule**	Low-bush cranberry	8.4
	Rosa acicularis	Prickly rose	4.3
	Alnus crispa	Green alder	3.7
Herb	**Cornus canadensis**	Bunchberry	10,3
	Linnaea borealis	Twinflower	10.0
	Equisetum sylvaticum	Horsetail	3.0
	Rubus pubescens	Dewberry	2.9
	Epilobium angustifolium	Fireweed	2.1
	Petasites palmatus	Coltsfoot	2.1
	Pyrola asarifolia	Common pink wintergreen	2.0
Grass	Presence < 60%		
Moss	**Pleurozium schreberi**	Schreber's moss	29.3
	Hylocomium splendens	Stairstep moss	23.0
	Ptilium crista-castrensis	Knight's plume moss	11.0
Lichen	Presence < 60%		

Comments

Common in area, represents young successional stages.

Lodgepole pine/Green alder/Bunchberry
Pinus contorta/Alnus crispa/Cornus canadensis

Site and Soil Characteristics

Slope : 5% (0-12)
Aspect : Variable
Parent materials : Morainal and glaciolacustrine blankets

Texture	:	Medium to moderately fine, moderately fine to fine, moderately fine to very fine in the A, B and the C horizons, respectively
Soil drainage	:	Moderately well to imperfectly drained
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic to submesotrophic
Soils	:	Orthic Grey Luvisol, Orthic Luvic Gleysol, Brunisolic Gray Luvisol
Number of plots	:	7

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Pinus contorta**	Lodgepole pine	31.7
Shrub	**Alnus crispa**	Green alder	27.9
	Rosa acicularis	Prickly rose	10.4
	Viburnum edule	Low-bush cranberry	10.3
	Ribes triste	Wild red currant	1.1
Herb	**Cornus canadensis**	Bunchberry	22.6
	Rubus pubescens	Dewberry	14.3
	Linnaea borealis	Twinflower	12.1
	Lycopodium annotinum	Stiff club moss	9.4
	Epilobium angustifolium	Fireweed	3.0
	Mertensia paniculata	Tall mertensia	2.9
	Mitella nuda	Bishop's cap	1.1
	Equisetum sylvaticum	Woodland horsetail	1.3
	Petasites palmatus	Coltsfoot	1.0
	Orthilia secunda	One-sided wintergreen	0.7
Grass	Presence < 10%		
Moss	**Pleurozium schreberi**	Schreber's moss	21.0
	Hylocomium splendens	Stairstep moss	19.9
	Ptilium crista-castrensis	Knight's plume moss	6.7
Lichen	Presence < 60%		

Comments

This association is commonly found at mid to lower slope positions so intermittent seepage may be present.

White Spruce-Low-bush cranberry-Feathermoss
Picea glauca-Viburnum edule-Hylocomium splendens

Site and Soil Characteristics

Slope	:	4% (0-10)
Aspect	:	Variable
Parent materials	:	Morainal blanket and fluvial veneer over moraine
Texture	:	Moderately fine, fine in the A, B and the C horizons, respectively
Soil drainage	:	Moderately well to imperfectly
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic
Soils	:	Orthic Gray Luvisol, Orthic Luvic Gleysol
Number of plots	:	3

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	20.0
	Populus tremuloides	Aspen	6.3
Shrub	**Viburnum edule**	Low-bush cranberry	26.7
	Rosa acicularis	Prickly rose	11.7
	Populus tremuloides	Aspen	4.3
	Ribes oxycanthoides	Wild gooseberry	0.7
Herb	**Linnaea borealis**	Twinflower	7.3
	Mertensia paniculata	Tall mertensia	7.3
	Cornus canadensis	Bunchberry	7.0
	Rubus pubescens	Dewberry	6.3
	Petasites palmatus	Coltsfoot	3.0
	Lycopodium annotinum	Stiff club moss	2.3
	Equisetum sylvaticum	Woodland horsetail	2.0
	Epilobium angustifolium	Fireweed	1.7
	Mitella nuda	Bishop's cap	1.3
	Fragaria virginiana	Wild strawberry	1.0
	Lathyrus ochroleucus	Cream-colored vetchling	1.0
	Maianthemum canadense	Wild lily-of-the-valley	1.0
	Orthilia secunda	One-sided wintergreen	1.0
	Pyrola asarifolia	Common pink wintergreen	1.0
	Viola renifolia	Kidney-leaved violet	0.7

Layer	Species		Mean Cover (%)
Grass	**Calamagrostis canadensis**	Marsh reed grass	7.3
Moss	**Hylocomium splendens**	Stair-step moss	52.7
	Pleurozium schreberi	Schreber's moss	13.3
Lichen	**Peltigera canina**	Dog lichen	0.7

Comments

Represents mature successional stages on modal sites.

White spruce/Green alder/Feathermoss
Picea glauca/Alnus crispa/Hylocomium splendens

Site and Soil Characteristics

Slope	:	6% (0-12)
Aspect	:	Variable
Parent materials	:	Morainal (blanket and veneer) and glaciolacustrine
Texture	:	Moderately fine, moderately fine to fine, fine to very fine in the A, B and C horizons respectively
Soil drainage	:	Moderately well to imperfectly drained
Ecological moisture regime	:	Subhydric to mesic
Ecological nutrient regime	:	Mesotrophic
Soils	:	Orthic, Brunisolic and Gleyed Gray Luvisol, Orthic Luvic Gleysol
Number of plots	:	4

Characteristic Species

Layer	Species		Mean Cover (%)
Trees	**Picea glauca**	White spruce	25.0
Shrub	**Alnus crispa**	Green alder	45.3
	Viburnum edule	Low-bush cranberry	10.8
	Rosa acicularis	Prickly rose	9.3

Layer	Species		Mean Cover (%)
Herb	**Cornus canadensis**	Bunchberry	35.0
	Linnaea borealis	Twinflower	22.0
	Orthilia secunda	One-sided wintergreen	0.8
	Epilobium angustifolium	Fireweed	8.3
	Lycopodium annotinum	Stiff club moss	6.8
	Mertensia paniculata	Tall mertensia	2.5
	Equisetum sylvaticum	Woodland horsetail	3.8
	Mitella nuda	Bishop's cap	3.3
	Petasites palmatus	Coltsfoot	1.0
Grass	Presence < 60%		
Moss	**Hylocomium splendens**	Stairstep moss	32.5
	Pleurozium schreberi	Schreber's moss	22.5
Lichen	Presence < 60%		

Comments

This association commonly occurs in mid to lower slope position and may benefit from temporary seepage.

White spruce-Balsam fir/Feathermoss
Picea glauca-Abies balsamea/Pleurozium schreberi

Site and Soil Characteristics

Slope	:	6% (0-12)
Aspect	:	Variable
Parent materials	:	Lacustrine blanket
Texture	:	Medium to moderately fine, medium to moderately fine, moderately fine to fine in the A, B and C horizons, respectively
Soil drainage	:	Moderately well to imperfectly
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic
Soils	:	Orthic Gray Luvisol, Brunisolic Gray Luvisol, Orthic Eutric Brunisol
Number of plots	:	3

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	24.0
	Abies balsamea	Balsam fir	20.0
Shrub	**Abies balsamea**	Balsam fir	6.3
	Rubus idaeus	Wild red raspberry	6.3
	Rosa acicularis	Prickly rose	1.7
	Viburnum edule	Low-bush cranberry	1.3
	Ribes lacustre	Bristly black currant	0.7
	Ribes triste	Wild red gooseberry	0.7
Herb	**Linnaea borealis**	Twinflower	36.7
	Cornus canadensis	Bunchberry	35.0
	Rubus pubescens	Dewberry	4.7
	Equisetum sylvaticum	Woodland horsetail	1.7
	Mertensia paniculata	Tall mertensia	1.7
	Mitella nuda	Bishop's cap	1.0
	Orthilia secunda	One-sided wintergreen	0.7
Grass	Presence < 60%		
Moss	**Pleurozium schreberi**	Schreber's moss	45.0
	Ptilium crista-castrensis	Knight's plume moss	40.0
	Hylocomium splendens	Stairstep moss	9.0

Comments

Succession to balsam fir is expected to be more rapid on cooler northerly slopes.

Black spruce/Labrador tea/Peat moss
Picea mariana/Ledum groenlandicum/Sphagnum spp.

Site and Soil Characteristics

Slope : 0%
Aspect : 0

Parent materials	:	Organic veneer
Texture	:	Mesic over fine textured materials
Soil drainage	:	Very poorly drained
Ecological moisture regime	:	Subhydric to hydric
Ecological nutrient regime	:	Oligotrophic to submesotrophic
Soils	:	Terric Mesisol, Terric Mesic Organic Cryosol
Number of plots	:	2

Characteristic Species

Layer	Species		Mean Cover (%)
Shrub	**Ledum spp.**	Labrador tea	35.0
	Betula glandulosa	Dwarf birch	11.5
	Picea mariana	Labrador Tea	35.0
Herb	**Vaccinium vitis-idaea**	Bog cranberry	25.0
	Rubus chamaemorus	Cloudberry	11.0
	Oxycoccus microcarpus	Small bog cranberry	1.0
Moss	**Sphagnum fuscum**	Sphagnum moss	62.5
Lichen	**Cladina mitis**	Reindeer lichen	1.0

Comments

High water table limits species composition. Association widespread on organic soils.

4.2.2 Boreal Mixedwood - Lower Subzone

Aspen is the pioneer species on modal sites throughout this subzone in contrast to lodgepole pine in the upper subzone. White spruce is the climax species throughout the lower subzone through succession rates appear to be variable. As a result of this and the variation in topography from rolling uplands to relatively flat plains, there are two variants identified: White spruce-Aspen and Aspen-White spruce.

White Spruce - Aspen Variant

This variant has a higher proportion of white spruce stands than the aspen-white spruce variant, probably because of the increased rainfall, generally cooler climate conditions (Table 3) and fire history associated with the upland areas where the variant occurs. Understory species are basically similar to the aspen-white spruce variant with the exception of the higher occurrence of buffalo-berry in the aspen-white spruce. The spatial distribution of plant communities is another differentiating factor as the topographical variation is much greater in the white spruce-aspen variant, leading to a more complex vegetation pattern.

Soils in the white spruce-aspen variant are dominantly Orthic Gray Luvisols with gleyed Luvisols, Brunisols and Organics present. Parent materials are dominantly morainal. There are five associations in the white spruce-aspen variant:

White spruce/Low-bush cranberry/Feathermoss

Aspen/Low-bush cranberry

Aspen/Alder

White spruce-Balsam fir/Feathermoss

White spruce/Horsetail

White spruce/Low-bush cranberry/Feathermoss
Picea glauca/Viburnum edule/Hylocomium splendens

Site and Soil Characteristics

Slope	:	4.3% (0-10)
Aspect	:	Generally northerly
Parent materials	:	Morainal blanket, moraine, fluvial terrace and glaciofluvial
Texture	:	High variability in each horizon from moderately coarse to very fine
Soil drainage	:	Well to imperfectly drained
Ecological moisture regime	:	Mesic (submesic to subhygric)
Ecological nutrient regime	:	Mesotrophic (submesotrophic to permesotrophic)
Soils	:	Luvisols, Gleysols, Brunisols, Regosols
Number of plots	:	15

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	36.9
	Populus tremuloides	Aspen	9.5
Shrub	**Rosa acicularis**	Prickly rose	14.4
	Viburnum edule	Low-bush cranberry	12.5
	Populus tremuloides	Aspen	3.5
Herb	**Linnaea borealis**	Twinflower	13.1
	Cornus canadensis	Bunchberry	11.2
	Rubus pubescens	Dewberry	6.7
	Mertensia paniculata	Tall mertensia	4.7
	Epilobium angustifolium	Fireweed	6.7
	Mitella nuda	Bishop's cap	4.1
	Petasites palmatus	Coltsfoot	2.6
	Orthilia secunda	One-sided wintergreen	1.1
	Pyrola asarifolia	Common pink wintergreen	0.9
	Lathyrus ochroleucus	Cream-colored vetchling	0.8
Grasses	Presence < 60%		

Layer	Species		Mean Cover (%)
Moss	**Hylocomium splendens**	Stairstep moss	46.7
	Ptilium crista-castrensis	Knight's plume moss	12.7
	Pleurozium schreberi	Schreber's moss	12.2
Lichens	Presence < 60%		

Comments

Widespread in variant, represents mature successional stages on modal sites.

Aspen/Low-bush cranberry
Populus tremuloides/Viburnum edule

Site and Soil Characteristics

Slope	:	Average slope, 3.9% (0-14)
Aspect	:	Variable
Parent materials	:	Glaciofluvial, fluvial and lacustrine
Texture	:	Variable
Soil drainage	:	Well to imperfectly drained
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic to submesotrophic
Soils	:	Luvisols, Gleysols and Brunisols
Number of plots	:	15

Characteristic Species

Layer	Species		Mean Cover (%)
Trees	**Populus tremuloides**	Aspen	43.3
Shrub	**Viburnum edule**	Low-bush cranberry	16.4
	Rosa acicularis	Prickly rose	8.4
Herb	**Cornus canadensis**	Bunchberry	15.4
	Epilobium angustifolium	Fireweed	6.9
	Linnaea borealis	Twinflower	6.4
	Mertensia paniculata	Tall mertensia	2.9
	Rubus pubescens	Dewberry	2.7

Layer	Species		Mean Cover (%)
	Petasites palmatus	Coltsfoot	1.6
	Lathyrus ochroleucus	Cream-colored vetchling	1.5
	Pyrola asarifolia	Common pink wintergreen	1.1
	Aster cilolatus	Lindlay's aster	1.1
	Fragaria virginiana	Wild strawberry	0.9
	Maianthemium canadense	Wild lily-of-the-valley	0.9
Herb	**Mitella nuda**	Bishop's cap	0.9
	Equisetum sylvaticum	Woodland horsetail	0.7
	Gallium boreale	Northern bedstraw	0.6
Grass	**Calamagrostis canadensis**	Marsh reed grass	15.6
Moss	**Hylocomium splendens**	Stairstep moss	9.7

Comments

Widespread in area, represents young successional stages on modal sites.

Aspen/Green alder
Populus tremuloides/Alnus crispa

Site and Soil Characteristics

Slope	:	7.2
Aspect	:	Variable
Parent materials	:	Morainal
Texture	:	Moderately fine, moderately fine to fine, very fine in A, B and C horizons, respectively. Coarse fragments were estimated at 14.8% (1-30%)
Soil drainage	:	Well to imperfectly drained
Ecological moisture regime	:	Mesic to submesic
Ecological nutrient regime	:	Mesotrophic to submesotrophic
Soils	:	Orthic Gray Luvisol, Orthic Luvic Gleysol, Eluviated Eutric Brunisol
Number of plots	:	6

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Populus tremuloides**	Aspen	35.0
Shrub	**Alnus crispa**	Green alder	17.7
	Viburnum edule	Low-bush cranberry	13.0
	Rosa acicularis	Prickly rose	3.8
Herb	**Cornus canadensis**	Bunchberry	10.0
	Rubus pubescens	Dewberry	5.2
	Linnaea borealis	Twinflower	3.7
	Epilobium angustifolium	Fireweed	2.2
	Petasites palmatus	Coltsfoot	1.7
Grasses	**Calamagrostis canadensis**	Marsh reed grass	7.5
Moss	**Hylocomium splendens**	Stair step moss	15.2
Lichens	None		

Comments

Intermittent seepage expected at these sites.

White spruce-Balsam fir/Feathermoss
Picea glauca-Abies balsamea/Hylocomium splendens

Site and Soil Characteristics

Slope	:	11.3% (2-20)
Aspect	:	Mainly northerly
Parent materials	:	Morainal
Texture	:	Medium to moderately fine, moderately fine to fine and fine in A, B and C horizons, respectively. Coarse fragment: 24.3% (ranging 0-50%)
Soil drainage	:	Moderately well drained
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic to submesotrophic (permesotrophic)
Soils	:	Orthic Gray Luvisol
Number of plots	:	4

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	21.8
	Abies balsamea	Balsam fir	21.0
Shrub	**Abies balsamea**	Balsam fir	28.8
	Rosa acicularis	Prickly rose	3.0
	Picea glauca	White spruce	2.3
	Viburnum edule	Low-bush cranberry	2.0
Herb	**Cornus canadensis**	Bunchberry	17.8
	Linnaea borealis	Twinflower	9.8
	Petasites palmatus	Coltsfoot	2.4
	Mertensia paniculata	Tall mertensia	1.3
	Rubus pubescens	Dewberry	1.8
	Equisetum sylvatium	Field horsetail	1.5
	Mitella nuda	Bishop's cap	0.8
	Orthilia secunda	One-sided wintergreen	0.5
	Pyrola asarifolia	Common pink wintergreen	0.3
Grass	Presence < 60%		
Moss	**Hylocomium splendens**	Stairstep moss	50.8
	Ptilium crista-castrensis	Knight's plume moss	50.8
	Pleurozium schreberi	Schreber's moss	10.5
Lichen	Presence < 60%		

Comments

Succession to balsam fir is more rapid on northerly slopes.

White spruce/Horsetail
Picea glauca/Equisetum spp.

Site and Soil Characteristics

Slope : 1.7% (0-3)
Aspect : 0
Parent materials : Organic veneer, fluvial, colluvial blanket

Texture	:	Variable, coarse fragments not present
Soil drainage	:	Moderately well to imperfect
Ecological moisture regime	:	Subhygric to hygric
Ecological nutrient regime	:	Permesotrophic to submesotrophic
Soils	:	Orthic Gleysol, Cumulic Regosol, Orthic Regosol
Number of plots	:	3

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	39.0
Shrub	**Rosa acicularis**	Prickly rose	4.7
	Ribes lacustre	Bristly black currant	0.7
	Ribes triste	Wild red currant	0.6
Herbs	**Equisetum arvense**	Common horsetail	21.0
	Equisetum pratense	Meadow horsetail	6.3
	Linnaea borealis	Twinflower	5.6
	Mertensia paniculata	Tall mertensia	4.7
	Cornus canadensis	Kidney-leaved violet	0.4
	Rubus pubescens	Dewberry	2.1
	Petasites palmatus	Coltsfoot	2.0
	Mitella nuda	Bishop's cap	1.7
	Delphinium glaucum	Tall larkspur	1.7
	Epilobium angustifolium	Fireweed	1.7
	Fragaria virginiana	Wild strawberry	1.0
	Galium boreale	Northern bedstraw	0.6
	Actaea rubra	Baneberry	0.4
	Lathyrus ochroleous	Cream-colored vetchling	0.4
	Viola renifolia	Kidney leaved violet	0.4
Grass	**Elymus innovatus**	Hairy wild rye	2.9
Moss	**Hylocomium splendens**	Stairstep moss	26.3
	Ptilium crista-castrensis	Knight's plume moss	15.4
	Pleurozium schreberi	Schreber's moss	1.7
	Dicranum fragifolium	Cushion moss	0.4
Lichen	**Cladonia gracilis**	Reindeer lichen	0.4

Comments

Occurs in lower slope positions and valley bottoms, often with seepage.

Aspen-White Spruce Variant

This variant generally has a higher proportion of aspen to white spruce in upland stands than does the white spruce-aspen variant. This could be a result of warmer, drier climatic conditions (Table 3) that would favor aspen by slowing successional rates and by influencing fire incidence.

Soils on upland sites are dominantly Luvisols with Solonetzic, Orthic and gleyed subgroups being common. Glacicolacustrine sediments are the dominant parent materials with some occurrence of subdued morainal topography. Organic deposits are locally extensive within the variant.

There are 12 associations within this variant:

White spruce/Buffalo-berry/Feathermoss

White spruce/Low-bush cranberry/Feathermoss

White spruce/Green alder/Feathermoss

Aspen/Low-bush cranberry/Wild sarsaparilla

Aspen/Buffalo-berry

White spruce/Horsetail

Jack pine/Bearberry

Pine/Feathermoss

Black spruce/Labrador tea/Peat moss

Black spruce/Labrador tea/Feathermoss

Tamarack/Labrador tea/Horsetail

White spruce/Buffalo-berry/Feathermoss
Picea glauca/Shepherdia canadensis/Hylocomium splendens

Site and Soil Characteristics

Slope	:	2%
Aspect	:	Variable
Parent materials	:	Lacustrine, morainal and glaciofluvial
Texture	:	Moderately fine to fine for each of A, B and C horizons
Soil drainage	:	Moderately well to imperfectly
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic to permesotrophic
Soils	:	Gleyed Gray Luvisol, Orthic Humic Gleysol, Orthic Gleysol
Number of plots	:	5

Characteristic Species

Layer	Species		Mean Cover (%)
Trees	**Picea glauca**	White spruce	35.0
	Populus tremuloides	Aspen	9.0
Shrub	**Shepherdia canadensis**	Buffalo-berry	15.0
	Viburnum edule	Low-bush cranberry	10.6
	Rosa acicularis	Prickly rose	6.6
	Populus tremuloides	Aspen	3.0
	Picea glauca	White spruce	2.2
Herb	**Linnaea borealis**	Twinflower	7.4
	Cornus canadensis	Bunchberry	7.0
	Epilobium angustifolium	Fireweed	3.0
	Lathyrus ochroleucus	Cream-colored vetchling	2.4
	Petasites palmatus	Coltsfoot	1.8
Herb	**Mertensia paniculata**	Tall mertensia	1.4
	Orthilia secunda	One-sided wintergreen	1.2

Layer	Species		Mean Cover (%)
Herb	**Galium boreale**	Northern bedstraw	1.0
	Maianthemum canadense	Wild lily-of-the vally	1.0
	Viola renifolia	Kidney-leaved violet	0.8
	Aster ciliolatus	Lindley's aster	0.6
Grass	**Elymus innovatus**	Hairy wild rye	9.0
Moss	**Pleurozium schreberi**	Schreber's moss	27.0
	Hylocomium splendens	Stairstep moss	22.0
Lichen	Presence <60%		

Comments

Widespread in zone, high cover of buffalo-berry not fully understood.

White spruce/Low-bush cranberry/Feathermoss
Picea glauca/Viburnum edule/Hylocomium splendens

Site and Soil Characteristics

Slope	:	2.7% (0-20)
Aspect	:	Variable
Parent materials	:	Morainal and lacustrine
Texture	:	Medium to moderately fine, moderately fine to fine, fine to very fine in A, B and C horizons, respectively
Soil drainage	:	Well to imperfectly
Ecological moisture regime	:	Mesic to submesic
Ecological nutrient regime	:	Mainly mesotrophic
Soils	:	Brunisols, Luvisols and Gleysols
Number of plots	:	19

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	39.5
	Populus tremuloides	Aspen	7.6

Layer	Species		Mean Cover (%)
Shrubs	**Rosa acicularis**	Prickly rose	11.1
	Viburnum edule	Low-bush cranberry	9.9
	Populus tremuloides	Aspen	1.9
Herbs	**Cornus canadensis**	Bunchberry	17.0
	Linnaea borealis	Twinflower	10.0
	Rubus pubescens	Dewberry	8.2
	Mertensia paniculata	Tall mertensia	5.0
	Mitella nuda	Bishop's cap	3.2
	Epilobium angustifolium	Fireweed	3.0
	Petasites palmatus	Coltsfoot	2.4
	Lathyrus ochroleucus vetchling	Cream-colored	1.8
	Fragaria virginiana	Wild strawberry	1.7
	Pyrolia asarifolia wintergreen	Common pink	1.5
Grass	Presence < 60%		
Moss	**Hylocomium splendens**	Stairstep moss	44.8
	Pleurozium schreberi	Schreber's moss	15.5
	Ptilium crista-castrensis	Knight's plume moss	4.8
Lichens	Presence < 60%		

Comments

Widespread in zone, represents mature successional stages on modal sites.

White spruce/Alder/Feathermoss
Picea glauca/Alnus crispa/Hylocomium splendens

Site and Soil Characteristics

Slope	:	5% (recorded for one plot only)
Aspect	:	SE (recorded for one plot only)
Parent materials	:	Glaciolacustrine
Texture	:	Medium to moderately fine, moderately fine to fine and moderately fine to very fine in A, B and C horizons
Soil drainage	:	Well to imperfectly

Ecological moisture regime: Mesic to subhygric
Ecological nutrient regime: Mesotrophic (one plot)
Soils : Dark Gray Luvisol, Orthic Gleysol and Gleyed Eutric Brunisol
Number of plots : 3

Characteristic Species

Layer	Species		Mean Cover (%)
Trees	**Picea glauca**	White spruce	53.0
	Populus tremuloides	Aspen	3.3
	Populus balsamifera	Balsam poplar	0.7
Shrubs	**Alnus crispa**	Green alder	44.4
	Viburnum edule	Low-bush cranberry	28.0
	Rosa acicularis	Prickly rose	14.7
	Lonicera involucrata	Bracted honeysuckle	8.4
	Populus balsamifera	Balsam poplar	3.7
	Populus tremuloides	Aspen	3.7
	Ribes oxycanthoides	Wild gooseberry	
Herbs	**Linnaea borealis**	Twinflower	24.3
	Mitella nuda	Bishop's cap	21.0
	Rubus pubescens	Dewberry	19.3
	Aster conspicuus	Showy aster	16.3
	Cornus canadensis	Bunchberry	14.7
	Aralia nudicaulis	Wild sarsaparilla	13.7
	Petasites palmatus	Coltsfoot	13.3
	Orthilia secunda	One-sided wintergreen	11.7
	Maianthemum canadense	Wild lily-of-the-valley	8.6
	Galium triflorum	Sweet-scented bedstraw	7.7
	Spirea betulifolia	White meadowsweet	7.3
	Epilobium angustifolium	Fireweed	6.7
	Mertensia paniculata	Tall mertensia	4.1
	Fragaria virginiana	Wild strawberry	2.1
	Viola spp.	Violet	2.1
	Galium boreale	Northern bedstraw	2.1
	Osmorhiza depauperatan	Sweet cicely	1.0
	Pyrola asarifolia	Common pink wintergreen	0.7
	Lathyrus ochroleucus	Cream-colored vetchling	0.4
Grass	Presence < 60%		

Characteristic Species

Layer	Species		Mean Cover (%)
Moss	**Hylocomium splendens**	Stairstep moss	23.0
	Pleurozium schreberi	Schreber's moss	16.0
	Ptilium crista-castrensis	Knight's plume moss	9.3
	Drepanocladus uncinatus		1.7
	Eurhynchium pulchellum		0.4
Lichens	**Peltigera canina**	Dog lichen	0.4

Comments

This association probably represents sites with intermittent seepage in soils.

Aspen/Low-bush cranberry/Wild sarsaparilla
Populus tremuloides/Viburnum edule/Aralia nudicaulis

Site and Soil Characteristics

Slope	:	1% (0-3)
Aspect	:	Variable
Parent materials	:	Morainal, lacustrine and fluvial
Texture	:	Medium to moderately fine, medium to fine, moderately fine to very fine in the A, B and C horizons, respectively
Soil drainage	:	Well to imperfect
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Submesotrophic
Soils	:	Orthic Gray Luvisol, Orthic Luvic Gleysol, Eluviated Eutric Brunisol, Orthic Gleysol, Solonetzic Gray Luvisol
Number of plots	:	13

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Populus tremuloides**	Aspen	46.5

Layer	Species		Mean Cover (%)
Shrub	**Viburnum edule**	Low-bush cranberry	13.0
	Rosa acicularis	Prickly rose	9.1
	Sheperdia canadensis	Buffalo-berry	2.5
	Populus tremuloides	Aspen	1.9
	Amelanchier alnifolia	Saskatoon	1.8
	Picea glauca	White spruce	1.5
Herbs	**Linnaea borealis**	Twinflower	9.8
	Cornus canadensis	Bunchberry	8.8
	Aralia nudicaulis	Wild sarsaparilla	7.1
	Epilobium angustifolium	Fireweed	7.0
	Rubus pubescens	Dewberry	3.2
	Aster conspicuus	Showy aster	3.1
	Lathyrus ochroleucus	Cream-colored vetchling	2.3
	Mertensia paniculata	Tall mertensia	2.3
	Petasites palmatus	Coltsfoot	2.1
	Fragaria virginiana	Wild strawberry	2.0
	Galium boreale	Northern bedstraw	1.8
	Pyrola asarifolia	Common pink wintergreen	1.3
	Vicia americana	Wild vetchling	0.8
Grass	**Elymus innovatus**	Hairy wild rye	19.1
	Calamagrostis canadensis	Marsh reed grass	7.9
Moss	**Hylocomium splendens**	Stairstep moss	20.2
	Pleurozium schreberi	Schreber's moss	8.2
Lichen	Presence < 60%		

Comments

These sites are very common in the area and occur in conjunction with the next association.

Aspen/Buffalo-berry
Populus tremuloides/Shepherdia canadensis

Site and Soil Characteristics

Slope : 3.6% (5-9)
Aspect : Variable

Parent materials	:	Morainal and lacustrine
Texture	:	Medium to moderately fine to fine, moderately fine to fine and fine to very fine in A, B and C horizons, respectively
Soil drainage	:	Moderately well to imperfect
Ecological moisture regime	:	Mesic to subhygric
Ecological nutrient regime	:	Mesotrophic
Soils	:	Orthic Gray Luvisol, Solonetzic Gray Luvisol, Ferra Luvic Gleysol and Gleyed Gray Luvisol
Number of plots	:	12

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Populus tremuloides**	Aspen	50.0
Shrub	**Sheperdia canadensis**	Buffalo-berry	37.1
	Rosa acicularis	Prickly rose	15.6
	Viburnum edule	Low-bush cranberry	13.8
	Populus tremuloides	Aspen	4.0
Herb	**Linnaea borealis**	Twinflower	16.8
	Cornus canadensis	Bunchberry	16.8
	Epilobium angustifolium	Fireweed	12.2
	Lathyrus ochroleucus	Cream-colored vetchling	7.6
	Aralia nudicaulis	Wild sarsaparilla	7.5
	Aster conspicuus	Showy aster	7.0
	Rubus pubescens	Dewberry	4.9
	Fragaria virginiana	Wild strawberry	4.8
	Vicia americana	Wild vetchling	4.7
	Petasites palmatus	Coltsfoot	4.3
	Mertensia paniculata	Tall mertensia	2.6
	Galium boreale	Northern bedstraw	1.8
Grass	Presence < 60%		
Moss	Presence < 60%		
Lichen	Presence < 60%		

Comments

This association is widespread in the variant. The high occurrence of buffalo-berry is not fully understood.

White spruce/Horsetail
Picea glauca/Equisetum spp.

Site and Soil Characteristics

Slope	:	0%
Aspect	:	
Parent materials	:	Morainal and lacustrine
Texture	:	Moderately fine to fine in the A horizon. In organic soils the texture was mesic to fibric. The B and C horizons had moderately fine to fine and fine to very fine textures, respectively
Soil drainage	:	Moderately well to very poorly
Ecological moisture regime	:	Mesic to hydric
Ecological nutrient regime	:	Mesotrophic to submesotrophic
Soils	:	Gleysol, Brunisol, Organic, Regosol
Number of plots	:	10

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea glauca**	White spruce	33.3
Shrub	**Rosa acicularis**	Prickly rose	10.0
	Viburnum edule	Low-bush cranberry	1.5
	Ribes lacustre	Bristly black currant	
Herb	**Equisetum arvense**	Common horsetail	13.9
	Linnaea borealis	Twinflower	5.4
	Cornus canadensis	Bunchberry	4.8
	Vaccinium vitis-idaea	Bog cranberry	3.1
	Mitella nuda	Bishop's cap	2.4
	Rubus pubescens	Dewberry	1.9
Moss	**Hylocomium splendens**	Stairstep moss	55.3
	Pleurozium schreberi	Schreber's moss	15.4
	Bracythecium salebrosum		
	Pohlia nutens	Copper wire moss	
Lichen	Presence < 60%		

Comments

Occurs in seepage areas and lower slope positions where nutrient availability is high.

Jack pine/Bearberry
Pinus banksiana/Arctostaphylos uva-ursi

Site and Soil Characteristics

Slope	:	0.8%
Aspect	:	Mostly level
Parent materials	:	Glaciofluvial
Texture	:	Coarse to moderately coarse in all horizons
Soil drainage	:	Well drained
Ecological moisture regime	:	Xeric to subxeric
Ecological nutrient regime	:	Oligotrophic to submesotrophic
Soils	:	Orthic Gray Luvisol, Eluviated Eutric Brunisol
Number of plots	:	4

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Pinus banksiana**	Jack pine	41.3
	Populus tremuloides	Aspen	2.0
Shrub	**Sherperdia canadensis**	Buffalo-berry	18.5
	Picea glauca	White spruce	6.3
	Rosa acicularis	Prickly rose	2.7
	Ledum groenlandicum	Labrador tea	1.2
	Betula papyrifera	Paper birch	
Herb	**Arctostapylos uva-ursi**	Bearberry	35.5
	Linnaea borealis	Twinflower	5.7
	Cornus canadensis	Bunchberry	4.0
	Lathyrus ochroleucus	Cream-colored vetchling	4.0
	Epilobium angustifolium	Fireweed	2.7
	Maianthemum canadenses	Wild lily-of-the-valley	0.8
	Galium boreale	Northern bedstraw	0.4
	Orthilia secunda	One-sided wintergreen	0.4

Layer	Species		Mean Cover (%)
	Geocaulon lividum	Northern comandra	0.1
Grass	**Elymus innovatus**	Hairy wild rye	12.3
Moss	**Pleurozium schreberi**	Schreber's moss	20.3
	Hylocomium splendens	Stairstep moss	19.0
Lichen	**Peltigera aphthosa**	Studded leather lichen	0.7
	Cladina mitis	Reindeer lichen	0.6
	Cladina rangiferina	Reindeer lichen	0.6
	Cladonia gracilis	Reindeer lichen	0.3
	Cladonia cornuta	Reindeer lichen	0.1

Comments

This association is common on dry sandy materials.

Pine/Feathermoss
Pinus spp./Pleurozium schreberi

Site and Soil Characteristics

Slope	:	4% (0-14)
Aspect	:	Variable
Parent materials	:	Morainal, glaciofluvial and glacio-lacustrine
Texture	:	Medium to fine in A, and fine to very fine in B and C horizons
Soil drainage	:	Well to moderately drained
Ecological moisture regime	:	Subxeric to mesic
Ecological nutrient regime	:	Submesotrophic to mesotrophic
Soils	:	Luvisols and Brunisols
Number of plots	:	11

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Pinus spp.**	Lodgepole pine or Jack pine	44.2

Layer	Species		Mean Cover (%)
Shrub	**Rosa acicularis**	Prickly rose	1.3
Herb	**Cornus canadensis**	Bunchberry	13.8
	Linnaea borealis	Twinflower	6.4
	Epilobium angustifolium	Fireweed	2.0
Herb	**Petasites palmatus**	Coltsfoot	0.9
	Equisetum sylvaticum	Woodland horsetail	0.2
Grass	Presence < 60%		
Moss	**Hylocomium splendens**	Stairstep moss	38.9
	Pleurozium schreberi	Schreber's moss	31.8
	Ptilium crista-castrensis	Knight's plume moss	6.9
	Ptilidium pulcherriam	Liverwort	0.2
Lichen	**Cladonia cornuta**	Reindeer lichen	0.1

Comments

These sites are expected to be dry for a significant portion of the growing season.

Black spruce/Labrador tea/Peat moss
Picea mariana/Ledum groenlandicum/Sphagnum spp.

Site and Soil Characteristics

Slope	:	Level
Aspect	:	
Parent materials	:	Organic, seldom mineral
Texture	:	
Soil drainage	:	Poor to very poor
Ecological moisture regime	:	Subhydric to hydric
Ecological nutrient regime	:	Oligotrophic to submesotrophic
Soils	:	Organic and Gleysolic
Number of plots	:	14

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea mariana**	Black spruce	6.4
Shrub	**Picea mariana**	Black spruce	31.2
	Ledum groenlandicum	Labrador tea	30.3
Herb	**Rubus chamaemorus**	Cloudberry	10.1
	Vaccinium vitis-idaea	Bog cranberry	8.2
	Oxycoccus microcarpus	Small bog cranberry	3.2
Grass	Presence < 60%		
Moss	**Sphagnum fuscum**	Peat moss	13.9
	Polytrichum strictum		1.2
	Mylia anomala		1.1
	Dicranum undulatum		0.6
	Pohlia nutans		0.3
Lichen	**Cladina mitis**	Reindeer lichen	26.7
	Cladonia deformis	Reindeer lichen	0.3
	Cladonia cornuta	Reindeer lichen	1.0

Comments

This association is widespread on organic soils in the area.

Black spruce/Labrador tea/Feathermoss
Picea mariaina/Ledum groenlandicum/Hylocomium splendens

Site and Soil Characteristics

Slope	:	0.6% (0-2)
Aspect	:	Variable
Parent materials	:	Organic, glaciofluvial, fluvial veneer and morainal
Texture	:	Only mineral horizons were assessed. Textural classes were fine to very fine, moderately fine to fine and medium to moderately fine in the A, B, C horizons, respectively
Soil drainage	:	Moderately well to very poorly
Ecological moisture regime:		Subhygric to hygric (subhydric)
Eclogical nutrient regime:		Submesotrophic

Soils	:	Terric Mesisol, Orthic Eutric Brunisol, Eutric Dystric Brunisol, Orthic Regosol, Rego Gleysol
Number of plots	:	9

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Picea mariana**	Black spruce	29.0
Shrub	**Ledum groenlandicum**	Labrador tea	33.2
	Picea mariana	Black spruce	16.6
Herb	**Equisetum arvense**	Common horsetail	10.7
	Vaccinium vitis-idaea	Bog cranberry	8.4
	Geocaulon lividum	Northern comandra	1.2
Grass	Presence < 60%		
Moss	**Hylocomium splendens**	Stairstep moss	49.1
	Pleurozium schreberi	Schreber's moss	38.2
Lichen	**Cladinia mitis**	Reindeer lichen	1.2
	Peltigera aphthosa	Studded leather lichen	0.9

Comments

These sites are in transition from organic to upland soils.

Tamarack/Labrador tea/Common horsetail
Larix laricina/Ledum groenlandicum/Equisetum arvense

Site and Soil Characteristics

Slope	:	0
Aspect	:	
Parent materials	:	Organic and Morainal
Texture	:	Fibric and fine textured
Soil drainage	:	Imperfect to very poor
Ecological moisture regime	:	Hygric to hydric
Ecological nutrient regime	:	Submesotrophic to permesotrophic
Soils	:	Organic and Cryosolic
Number of plots	:	5

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Larix laricina**	Tamarack	25.2
	Picea mariana	Black spruce	8.0
Shrub	**Ledum groenlandicum**	Labrador tea	25.6
	Larix laricina	Tamarack	10.2
	Picea mariana	Black spruce	9.0
	Alnus tenuifolia	River alder	7.0
	Ribes lacustre	Bristly black currant	1.6
Herb	**Equisetum arvense**	Common horsetail	17.4
	Vaccinium vitis-idaea	Bog cranberry	9.8
	Mitella nuda	Bishop's cap	2.1
	Epilobium angustifolium	Fireweed	1.7
	Oxycoccus microcarpus	Small bog cranberry	1.6
	Rubus pubescens	Dewberry	1.2
	Linnaea borealis	Twinflower	1.0
	Rubus arcticus	Dwarf raspberry	0.9
	Viola renifolia	Kidney leaved violet	0.3
	Geocaulon lividum	Northern comandra	0.1
	Moehringia lateriflora	Blunt-leaved sandwort	0.1
	Orthilia secunda	One-sided wintergreen	0.1
Grass	**Calamagrostis canadensis**	Marsh reed grass	15.2
	Carex gynocrates	Northern sedge	7.8
Moss	**Hylocomium splendens**	Stairstep moss	16.0
	Tomenthypnum nitens	Golden moss	13.2
	Aulacomnium palustre	Tufted moss	5.4
	Brachythecium salebrosum		0.1
	Bryum pseudotriquetra		0.1
	Leptarrhena pyrolifolia		0.1
	Thuidium recognitum		0.1
Lichen	**Peltigera aphthosa**	Studded leather lichen	0.9

Comments

This association is widespread in the area and represents more nutrient rich organic soils than the Black spruce/Labrador tea/Peat moss association.

4.3 Aspen Parkland Zone

The Aspen Parkland occupies a relatively small portion of the Northwest Study Area, mainly along the Peace River and in the vicinity of Grande Prairie. The ecozone is largely under cultivation at present making study of native vegetation patterns difficult. As a result, the zone line is based on the occurrence of Black and Dark Gray soil subgroups.

A number of studies have documented the occurrence of Parkland type vegetation in the area, notably Moss (1952) and Wilkinson and Johnson (1982). One significant difference between this section of the Aspen Parkland and the portion in central Alberta is the absence of rough fescue (**Festuca scrabrella**).

Climate Conditions

The Aspen Parkland Zone represents the warmest climate in the northwest of the province (Table 1). Growing degree days (May-Sept. above 5°C) average 1181 which is significantly higher than the rest of the study area and comparable to the aspen parkland area in central Alberta. Rainfall is significantly lower than the Boreal Mixedwood Zone. The aspen-white spruce variant of the Boreal Mixedwood, however, has rainfall totals only slightly higher than the Aspen Parkland (Appendix 3). This similar pattern is expected as these are adjacent lowland areas. Significant differences between the Aspen Parkland and other zones are also found in potential evapotranspiration and moisture deficit.

Ecological Conditions

Aspen is the dominant tree species in the zone though its distribution is limited because of extensive cultivation in this area. White spruce is the expected climax species but rates of succession are slower than in the Boreal Mixedwood because of the warmer, drier climate in the Aspen Parkland. Balsam fir is not expected to occur to any extent in this zone.

Shrub and herb layers are well developed in the zone. Dominant shrub species are rose, snowberry and buffalo-berry. Saskatoon is a common component of the shrub layer though its cover is variable. The herb layer is dominated by wild vetch, bedstraw, peavine and showy aster. The moss layer is generally light.

Soils in the zone are dominantly of the Solonetzic order with Luvisols and some Chernozems also common. A large portion of these soils have developed on fine textured glaciolacustrine materials, resulting in the dominance of moderately well to imperfect drainage classes.

Only one association has been identified for the Aspen Parkland zone: Aspen/Prickly rose/Peavine.

Aspen/Prickly rose/Peavine
Populus tremuloides/Rosa acicularis/Lathyrus ochroleucus

Site and Soil Characteristics

Slope	:	1.5% (0-3)
Aspect	:	Variable
Parent materials	:	Morainal and lacustrine

Texture	:	Variable in each horizon from medium to fine
Soil drainage	:	Well to imperfectly drained
Ecological moisture regime:		Mesic to subhygric
Ecological nutrient regime:		Mesotrophic
Soils	:	Luvisolic, Solonetzic, Gleysolic and Chernozemic
Number of plots	:	10

Characteristic Species

Layer	Species		Mean Cover (%)
Tree	**Populus tremuloides**	Aspen	53.5
Shrub	**Rosa acicularis**	Prickly rose	23.5
	Sheperdia canadensis	Buffalo-berry	18.7
	Populus tremuloides	Aspen	7.9
	Viburnum edule	Low-bush cranberry	3.9
	Symphoricarpos albus	Snowberry	2.2
Herb	**Lathyrus ochroleucus**	Peavine	19.0
	Rubus pubescens	Dewberry	12.2
	Epilobium angustifolium	Fireweed	9.9
	Cornus canadensis	Bunchberry	7.6
	Fragaria virginiana	Wild strawberry	7.3
	Galium boreale	Northern bedstraw	6.1
	Vicia americana	Wild vetch	6.0
	Aster conspicuus	Showy aster	4.3
	Mertensia paniculata	Tall mertensia	2.5
	Aster ciliolatus	Lindley's aster	1.1
Grass	Presence < 60%		

Comments

This association could likely be subdivided upon further study in the zone. This is difficult, however because of the lack of undisturbed native vegetation.

4.4 Key to Plant Associations

4.4.1 Boreal Mixedwood Upper Subzone

A. Soils with organic horizons

Black spruce/Labrador tea/Peat moss
(**Picea mariana/Ledum groenlandicum/Sphagnum**)

AA. Soils with mineral horizons

B. Plant associations dominated by White spruce or a mixed white and Balsam fir stands

C. White spruce is dominant

D. In the shrub understory low-bush cranberry is abundant, soils well-drained, mottling mostly absent

White spruce/Low-bush cranberry/Feathermoss
(**Picea glauca/Viburnum edule/Hylocomium splendens**)

DD. Dominant undershrub is green alder, soils well to imperfectly drained, mottling and seepage may be present.

White spruce/Green alder/Feathermoss
(**Picea glauca/Alnus crispa/Hylocomium splendens**)

CC. Mixed white and balsam fir present, soils well drained.

White spruce-balsam fir/Feathermoss
(**Picea glauca-Abies balsamea/Hylocomium splendens**)

BB. Plant associations dominated by lodgepole pine.

C. Shrub layer with abundant ericaceous shrubs such as Labrador tea (**Ledum groenlandicum**), blueberry (**Vaccinium myrtilloides**) and bog cranberry (**Vaccinium vitis-idaea**), on well to moderately well drained soils.

Lodgepole pine/Labrador tea/Feathermoss
(**Pinus contorta/Ledum groenlandicum/Pleurozium schreberi**)

CC. The shrub layers of plant associations dominated by shrubs other than ericaceous shrubs.

D. Shrub layer with abundant green alder (**Alnus crispa**), soils well to imperfectly drained, mottling and seepage commonly present.

Lodgepole pine/Green alder/Bunchberry
(**Pinus contorta/Alnus crispa/Cornus canadensis**)

DD. Shrub layer with abundant low-bush cranberry (**Viburnum edule**), soils well-drained, mottling and temporary seepage mostly absent.

Lodgepole pine/Low-bush cranberry/Feathermoss
(**Pinus contorta/Viburnum edule/Pleurozium schreberi**)

Successional Relationships of Some Plant Associations of the Boreal Mixedwood Zone, Upper Subzone

Mid to Late Successional Stages	Near Final Successional Stages
Lodgepole pine/ Green alder/ Bunchberry	White spruce- Green alder/ Feathermoss
Lodgepole pine/ Low-bush cranberry/ Feathermoss	White spruce/ Low-bush cranberry/ Feathermoss

4.4.2 Boreal Mixedwood Zone, Lower Subzone, White Spruce-Aspen Variant

A. Plant associations dominated by aspen with abundant low-bush cranberry or green alder

B. The shrub layer with abundant low-bush cranberry.

Aspen/Low-bush cranberry
(**Populus tremuloides/Viburnum edule**)

BB. The shrub layer with abundant green alder

Aspen/Green alder
(**Populus tremuloides/Alnus crispa**)

AA. Plant associations are dominated by white spruce or mixed white spruce-balsam fir

B. Dominant trees are white spruce, moisture regime submesic or subhygric to hygric, low-bush cranberry may be abundant or of limited occurrence

C. Low-bush cranberry abundant, moisture regime submesic to mesic

White spruce/Low-bush cranberry/Feathermoss
(**Picea glauca/Viburnum edule/Hylocomium splendens**)

CC. Low-bush cranberry of limited occurrence, soil moisture regime subhygric to hygric

White spruce/Horsetail
(**Picea glauca/Equisetum**)

BB. Plant associations are dominated by mixed white spruce-balsam fir

C. White spruce-balsam fir/Feathermoss
(**Picea glauca-Abies balsamea/Hylocomium splendens**

Successional Relationships

Mid to Late Successional Stages	Late to Final Successional Stages
Aspen/Low-bush cranberry/ Dewberry	White spruce/Low-bush cranberry/feathermoss
Aspen/Green alder	White spruce-Balsam fir/Feathermoss

4.4.3 Boreal Mixedwood Zone, Lower Subzone, Aspen-White Spruce Variant

A. Soils with organic horizons

B. Organic layers principally of peat moss, H is strongly acidic, moisture regime subhydric to hydric

Black spruce/Labrador tea/Peat moss
(**Picea mariana/Ledum groenlandicum/Sphagnum** spp.)

BB. Organic layers of graminoids, pH neutral to slightly alkaline, moisture regime subhydric to hydric

Tamarack/Labrador tea/Horsetail
(**Larix laricina/Ledum groenlandicum/Equisetum arvense**)

AA. Soils with mineral horizon

B. Plant associations are dominated by aspen with low-bush cranberry or buffalo-berry as main shrub species.

C. Plant associations with low-bush cranberry as a dominant shrub

Aspen/Low-bush cranberry/Wild sarsaparilla
(**Populus tremuloides/Viburnum edule/Aralis nudicaulis**)

CC. Plant associations with buffalo-berry as a dominant shrub

Aspen/Buffalo-berry
(**Populus tremuloides/Sheperdia canadensis**)

BB. Plant associations are dominated by pine or spruce

C. Plant associations with pine as major tree

D. Jack pine is common, soil coarse to moderately coarse and rapidly drained, moisture regime dry.

Jack pine/Bearberry
(**Pinus banksiana/Arctostaphyllos uva-ursi**)

DD. Tree cover of mixed jack pine and lodgepole pine. Soils with medium to fine texture, well to moderately well drained.

Pine/Feathermoss
(**Pinus contorta/Pinus banksiana/Pleurozium schreberi**)

CC. Plant associations with black spruce and white spruce

D. Plant association with black spruce and abundant ericaceous shrubs

Black spruce/Labrador tea/Feathermoss
(**Picea mariana/Ledum groenlandicum/Hylocomium splendens**)

DD. Plant associations with white spruce, non-ericaceous shrubs present or absent.

E. Non-ericaceous shrubs are absent, soil drainage subhygric to hygric.

White spruce/Horsetail
(**Picea glauca/Equisetum** spp.)

EE. Non-ericaceous shrubs are present and abundant with or without nitrogen fixing ability.

F. Shrub species with nitrogen fixing ability.

G. Dominant shrub buffalo-berry or green alder

White spruce/Buffalo-berry/Feathermoss (**Picea glauca/Sheperdia canadensis/Hylocomium splendens**)

GG. Dominant species green alder, intermittent seepage may be present.

White spruce/Green alder/Feathermoss (**Picea glauca/Alnus crispa/Hylocomium splendens**)

FF. Shrub species - low-bush cranberry - lacks nitrogen fixing ability.

White spruce/Low-bush cranberry/Feathermoss (**Picea glauca/Viburnum edule/Hylocomium splendens**)

Successional Relationships

Mid to Late Successional Stages	Late to Final Successional Stages
Aspen-Low-bush cranberry Wild sarsaparilla	White spruce-Low-bush cranberry-Feathermoss
Aspen-Buffalo-berry	White spruce-Buffalo-berry

4.5 Forest Productivity

Forest productivity data for the study area (Table 4, Appendix 5) show only a few trends. The modal Boreal Subarctic Association (Lodgepole pine/Labrador tea/Lichen) has significantly lower site index for lodgepole pine and lower mean annual increments than the modal lodgepole pine sites in the Boreal Mixedwood. The Aspen Parkland Zone is also expected to have lower productivity than the Boreal Mixedwood because of generally drier site conditions but no data are available for this area.

Within the Boreal Mixedwood, only associations occurring on wet sites (black spruce and tamarack dominated) show significantly lower productivity. This is to be expected because of restrictive edaphic conditions. The upper and lower subzones show no obvious differences in site index values, but mean annual increments appear to be higher in the lower subzone, particularly in the Aspen-White Spruce Variant. This is possibly a result of the more favorable climate at lower elevations.

Comparisons in productivity between individual associations are not discussed in this section because of the small sample sizes for most associations and the overlap in the range of values for most associations.

Table 4

FOREST PRODUCTIVITY FOR PLANT ASSOCIATIONS IN NORTHWESTERN ALBERTA

Plant Associations	Site Index @ 50 yrs.	# Plots	Tree Species	Mean Annual Increment m /ha/yr	# Plots	Zone
1* Lodgepole pine-Black spruce/ Labrador tea/Lichen	10.4 9.6	(3) (2)	Lodgepole pine Black spruce	1.22	(3)	Boreal Subarctic
3 Lodgepole pine/Labrador tea/ Feathermoss	15.6 11.8	(5) (1)	Lodgepole pine Black spruce	2.25	(5)	Boreal Mixedwood-Upper
4 Lodgepole pine/Low-bush cranberry/Feathermoss	12.3 13.1 12.8 14.2	(2) (1) (4) (1)	White spruce Black spruce Lodgepole pine Aspen	2.10	(2)	
5 Lodgepole pine/Green alder/ Bunchberry	14.7 15.5	(7) (2)	Lodgepole pine White spruce	1.53	(1)	
6 White spruce/Low-bush cranberry/ Feathermoss	11.1	(1)	White spruce	----	---	
7 White spruce/Alder/Feathermoss	15.9	(4)	White spruce	3.66	(2)	
8 White spruce-Balsam fir/ Feathermoss	13.2	(2)	White spruce			
10 White spruce/Low-bush cranberry/Feathermoss	13.1 16.0	(12) (1)	White spruce Balsam fir	2.98	(7)	Boreal Mixedwood - Lower White spruce-Aspen Variant
11 Aspen/Low-bush cranberry	12.6 18.6	(5) (8)	White spruce	2.77	(4)	
12 Aspen/Alder	18.7	(2)	Aspen	2.95	(1)	
13 White spruce-Balsam Fir/ Feathermoss	11.9 7.5 9.3 15.4 13.0	(4) (1) (1) (2) (1)	White spruce Black spruce Lodgepole pine Balsam fir Aspen	2.93	(2)	
14 White spruce/Horsetail	12.5	(2)	White spruce	4.92	(1)	

Table 4 (continued)

Plant Associations	Site Index @ 50 yrs.	# Plots	Tree Species	Mean Annual Increment m /ha/yr	# Plots	Zone
15 White spruce/Buffalo-berry/ Feathermoss	14.9 19.3	(4) (2)	White spruce Aspen	3.17	(4)	Boreal Mixedwood-Lower Aspen-White spruce variant
16 White spruce/Low-bush cranberry/ Feathermoss	13.2 17.6 15.8 16.2	(16) (1) (2) (1)	White spruce Lodgepole pine Aspen Balsam poplar	3.39	(12)	
17 White spruce/Alder/Feathermoss	12.6	(1)	White spruce	3.29	(1)	
18 Aspen/Low-bush cranberry/ Dewberry	14.6 18.6	(4) (7)	White spruce Aspen	3.67	(4)	
19 Aspen/Buffalo-berry	15.6 17.2	(3) (4)	White spruce Aspen	3.12	(4)	
20 White spruce/Horsetail	10.0 8.7 13.4 12.1	(10) (1) (1) (2)	White spruce Black spruce Aspen Paper birch	2.51	(9)	
21 Jack pine/Bearberry	13.3	(4)	Jack pine	2.74	(4)	
22 Pine/Feathermoss	11.7 10.7 13.2 14.0 15.2 19.6 9.7	(6) (3) (9) (4) (3) (1) (2)	White spruce Black spruce Lodgepole pine Jack pine Aspen Balsam poplar Paper birch	4.31	(8)	
23 Black spruce/Labrador tea/ Sphagnum	7.7	(7)	Black spruce	0.20	(6)	
24 Black spruce/Labrador tea/ Feathermoss	6.6 7.2 7.3	(3) (9) (1)	White spruce Black spruce Balsam fir	1.04	(5)	
25 Tamarack	7.7 6.1 6.2	(3) (4) (5)	White spruce Black spruce Tamarack	0.80	(5)	

* Numbers correspond to association number in vegetation and environmental tables.

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